QST

DEVOTED ENTIRELY TO

AMATEUR RADIO

PUBLISHED SINCE 1915 BY THE AMERICAN RADIO RELAY LEAGUE INC.

SEPTEMBER
1928

25c

Precision...

FOR THE AMATEUR TOO

Frequency standardization and the development of frequency standards has been a work of primary importance to the General Radio Company since its foundation. Paralleling the precision standards designed for commercial laboratories, low-priced instruments have been constantly produced to meet the increasingly rigid requirements of amateur radio. Three types of meters are now available for specific uses in the Amateur spectrum.

TYPE 558 AMATEUR BAND WAVEMETER

The type 558 wavemeter is specifically designed for the new international amateur wavelength bands. The coils cover only the wavelength bands actually assigned for amateur use. This feature permits spreading each band over the entire condenser scale, resulting in great accuracy of setting. The guaranteed precision of this intrument is 0.25%, the same as that of the Type 224 Precision wavemeter costing ten times as much. Coils are provided for the 5, 10, 20, 40 and 80 meter bands. Mounted calibration charts are supplied with the instrument.

TYPE 558 WAVEMETER

Price $20.00

TYPE 358 AMATEUR WAVEMETER

The type 358 wavemeter covers a continuous range from 14 to 220 meters which includes five of the bands open to Amateurs, as well as the experimental and short-wave commercial bands. The greater range of this instrument does not permit as great an accuracy of calibration as is supplied with the 558, the calibration being good to 1%. A mounted calibration chart is provided.

TYPE 358 AMATEUR WAVEMETER

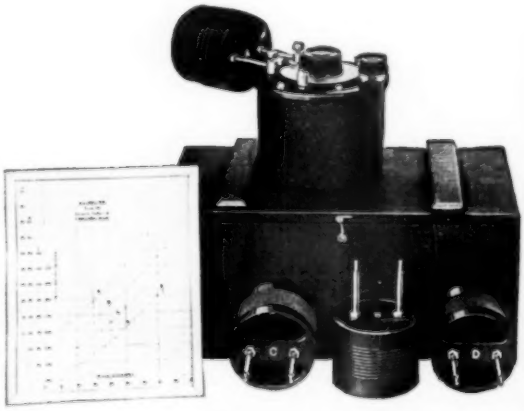
Price $15.00

TYPE 458 5 METER WAVEMETER

The type 458 wavemeter covers only the range from 4 to 6.5 meters and is designed for use by those experimenters who are working extensively in this region to the exclusion of other bands. The accuracy of calibration is 1%. A mounted calibration chart is supplied with each instrument.

TYPE 458 WAVEMETER

Price $8.00



GENERAL RADIO Co

Write for new Bulletin No. 930 with direct to consumer prices
You will find many items of interest.

30 State St., Cambridge, Mass. 274 Brannan St., San Francisco, Calif.

QST

The Official Organ of the A·R·R·L

VOLUME XII | SEPTEMBER 1928 | NUMBER 9

QST is published monthly by The American Radio Relay League, Inc., at Hartford, Conn., U. S. A.
Official Organ of the A.R.R.L. and the International Amateur Radio Union

Kenneth B. Warner (Secretary, A.R.R.L.), Editor-in-Chief and Business Manager
F. Cheyney Beckley, Managing Editor and Advertising Manager

Harold P. Westman, Technical Editor
Ross A. Hull, Associate Technical Editor
David H. Houghton, Circulation Manager

Subscription rate in United States and Possessions, Canada, and all countries in the American Postal Union, $2.50 per year, postpaid. Single copies, 25 cents. Foreign countries not in American Postal Union, $3.00 per year, postpaid. Remittances should be by international postal or express money order or bank draft negotiable in the U. S. and for an equivalent amount in U. S. funds.

Entered as second-class matter May 29, 1919, at the post office at Hartford, Connecticut, under the act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized September 9, 1922. Additional entry as second-class matter, acceptable at special rate of postage provided for above, at Springfield, Mass., authorized September 17, 1924.

The American Radio Relay League

The American Radio Relay League, Inc., is a non-commercial association of radio amateurs, bonded for the promotion of interest in amateur radio communication and experimentation, for the relaying of messages by radio, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

It is an incorporated association without capital stock, chartered under the laws of Connecticut. Its affairs are governed by a Board of Directors, elected every two years by the general membership. The officers are elected or appointed by the Directors. The League is non-commercial and no one commercially engaged in the manufacture, sale or rental of radio apparatus is eligible to membership on its board.

"Of, by and for the amateur", it numbers within its ranks practically every worth-while amateur in the world and has a history of glorious achievement as the standard-bearer in amateur affairs.

Inquiries regarding membership are solicited. A bona fide interest in amateur radio is the only essential qualification; ownership of a transmitting station and knowledge of the code are not prerequisite. Correspondence should be addressed to the Secretary.

DIRECTORS

President
HIRAM PERCY MAXIM
Drawer 2102,
Hartford, Conn.

Vice-President
CHARLES H. STEWART
St. David's, Pa.

Canadian General Manager
A. H. K. RUSSELL
5 Mail Bldg.,
Toronto, Ont.

Atlantic Division
DR. EUGENE C. WOODRUFF
234 W. Fairmount Ave.,
State College, Pa.

Central Division
CLYDE E. DARR
137 Hill Ave., Highland Park,
Detroit, Mich.

Dakota Division
C. M. JANSKY, JR.
Dept. of Elec. Eng., U. of M.,
Minneapolis, Minn.

Delta Division
BENJ. F. PAINTER
424 Hamilton Nat'l Bank Bldg.,
Chattanooga, Tenn.

Hudson Division
DR. LAWRENCE J. DUNN
480 East 19th St.,
Brooklyn, N. Y.

Midwest Division
PORTER H. QUINBY
817 Lauderman Building,
St. Louis, Mo.

New England Division
DR. ELLIOTT A. WHITE
Dartmouth College,
Hanover, N. H.

Northwestern Division
K. W. WEINGARTEN
3219 No. 24th St.,
Tacoma, Wash.

Pacific Division
ALLEN H. BABCOCK
65 Market St.,
Southern Pacific Co.,
San Francisco

Roanoke Division
W. TREDWAY GRAVELY
Box 245,
Danville, Va.

Rocky Mountain Division
PAUL M. SEGAL
Box 1771
Denver, Colo.

Southeastern Division
HARRY F. DOBBS
c/o Dobbs & Wey Co.,
245 Spring St., N. W.,
Atlanta, Ga.

West Gulf Division
FRANK M. CORLETT
2515 Catherine St.,
Dallas, Tex.

OFFICERS

President . . . . . HIRAM PERCY MAXIM, Hartford, Conn.
Vice-President . . . . . CHAS. H. STEWART, St. David's, Pa.
Secretary . . . . . KENNETH B. WARNER, Hartford, Conn.
Treasurer . . . . . ARTHUR A. HEBERT, Hartford, Conn.
Communications Manager . . F. EDWARD HANDY, Hartford, Conn.

ADDRESS ALL GENERAL CORRESPONDENCE TO THE EXECUTIVE HEADQUARTERS AT HARTFORD, CONN.

EDITORIALS

IN the spring of 1927 the Radio Division, Department of Commerce, abandoned the issuing of Amateur Extra First Grade Radio Operator Licenses because of the apparent lack of amateur interest. In the several years that this type of licenses was available only about 150 of them were issued. Immediately it was abandoned, great disappointment was expressed by amateurs, and during the year the feeling grew in amateur circles that we had not properly appreciated this recognition of the amateur by the Department and that we desired its reinstatement. By the time our Board met this spring there was a definite desire in amateur ranks to secure its restoration, and our Board accordingly petitioned the Radio Division. Now we are happy to announce that this grade of license has been reinstituted, new blanks have been engraved, and all of the offices of the Radio Division throughout the country are prepared to issue them to amateur applicants.

The offering of this superior grade of amateur operator's license is a stimulus to amateur proficiency and achievement, and something in which great pride can be taken by the holder. In earlier days the quite capable amateur could establish his proficiency by taking out a commercial license but there is to-day such a great difference between amateur equipment and commercial equipment, because of the now vast difference in wavelengths and methods, that it is only infrequently that an amateur is able to pass the commercial examination, and only after special study for that purpose. And even then it does not indicate particularly his greater proficiency as an amateur.

The new form of "ticket", on the brown form, is distinctively an amateur license, and the providing of it by the Division is a pretty recognition of amateur radio. To be eligible for this examination the applicant must have had at least two years' experience as a radio operator and must not have been penalized for violation of the radio laws—his record with the Radio Division must be clean. A speed of not less than 20 words per minute in Continental Morse receiving and transmitting must be attained, the same speed as for a commercial license. A special examination broader in scope than the regular amateur examination is given, with the requirement of 75% as a passing mark.

We wanted this grade of license restored. It has been done. It is now distinctly up to us to "patronize" it. Every amateur who can meet the requirements ought to undertake to possess himself of one of these licenses at the earliest possible date. It becomes the distinguishing mark of the superior amateur. The Radio Division itself, and the military branches which offer appointments to amateurs, will inevitably recognize it as such. It is a spur to individual achievement, something of which we may rightfully be proud. Let us show our appreciation of the Division's kindness in restoring this special grade of license by giving them lots of "customers".

THIS business of monitoring all transmissions from an amateur station, as is consistently recommended in Mr. Hull's series of transmitting articles, is a most useful and valuable idea. It is nothing short of strange that we went so many years without doing it. Its necessity is now perfectly apparent.

Most amateurs go along for years listening to every signal in the world except those from their own transmitter, which should be the first ones they listen to! This failure undoubtedly is responsible for the poor notes one hears on the air. It may be demonstrated easily to anyone's satisfaction that it is not possible to adjust any transmitter correctly, however good it is, by the use of meters alone. Adjustments for satisfactory output and for good efficiency are by no means sufficient, for in spite of these a good transmitter may still put out a signal of poor tone, chirping and creeping, infested with key clicks, and sensitive to every slight movement of the antenna. Yet all of these weaknesses are disclosed instantly by monitoring the transmission, so that one may know exactly what the signal sounds like to the distant station. When a monitor is used it becomes unnecessary to solicit numerous signal reports and attempt to secure some intelligent mean by discounting the over-enthusiastic ones and bolstering the ultra-conservative. What a tremendous amount of time and effort this saves, and what a vast amount of unnecessary interference it removes from the air! The only thing a distant receiver can report to the operator of a monitored transmitter which the latter does not already know about his signals is their audibility at the receiving station.

The 1929 station whose signal goes bad in quality or whose frequency begins to crawl, will be completely out of luck, lost in the mêleé. Monitoring prevents this, for it is instantly known to the transmitting opera-

tor. Every amateur who desires to be successful in 1929 must arrange to monitor his emissions.

THE letter from Mr. Shaw, published in this month's "Correspondence," raises some interesting points. In addition to bringing us new technical difficulties, the Washington Convention presents us with some modifications in operating procedure and with several sets of entirely new abbreviations. Like the rest of the convention, these become effective on January 1st. In early issues *QST* will present all of this information which has an amateur application.

The changes in operating procedure itself are trivial and of course will be handled by our Communications Section in its codification of our *Rules & Regulations*. Then there are a simpler and much more sensible set of audibility signals, a brand new and much more extensive set of "Q" signals, and a rather extensive list of one-, two- and three-letter abbreviations. All of these have meanings internationally agreed and they are binding upon all classes of stations, so that we must adopt them and become familiar with them and drop our old abbreviations at the end of this year.

Amateur stations are neither stations of the "fixed service" nor of the "mobile service". They are separately provided for as one of the classes of private experiment stations, and they have their own privileges and restrictions in the convention. All of this will be much better understood by studying a complete copy of the convention, which also includes, of course, all of the abbreviations and tables mentioned. Really a copy should be in every amateur "shack." A copy of the English translation of the document, known as "International Radiotelegraph Convention, Together With General Regulations and Supplementary Regulations Attached Thereto," may be obtained from the Superintendent of Documents, Government Printing Office, Washington, for twenty-five cents.

The prefix for a general call to all stations has been changed from "QST" to "CQ" and the former is now a blank in the international list of "Q" signals. That doesn't mean that *QST* is going to change its name, though. If some uncomplimentary meaning had been assigned the letters "QST", such as "You interfere with me—get out," we might have to. But now that *QST* is left blank in the international list, it becomes exclusively the name of a good amateur magazine.

—K. B. W.

Standard Frequency Transmissions from 9XL

STATION 9XL is a special station, comprising one of the three portions of the "Gold Medal Station", WCCO—9XL—9WI at Anoka, Minnesota. WCCO is operated as a broadcast station, 9XL purely as a standard frequency station and 9WI as a general amateur station, the three transmitters having independent equipment and antennas but a common power supply. Through arrangements made by K. V. R. Lansingh of the Official Wave Length Station Committee of the Experimenters' Section, A. R. R. L., 9XL is operated on schedules regularly announced in *QST*. The work of operating the station is done without charge by Chief Operator Hugh S. McCartney with the assistance of Lyall K. Smith and Ivan H. Anderson also on the staff of WCCO.

While no guarantee of accuracy is made on a gratis service, it is the aim of the staff to maintain an accuracy of 1/10 of 1%, which is materially better than can be held by most frequency meters. The frequencies are measured by means of standards which have been especially standardized for this purpose by the Bureau of Standards.

A small percentage of tone modulation is employed so that the signal is distinctive and more quickly recognizable.

The fact that this service has been rendered in the past is no guarantee of its continuing indefinitely in the future. It depends upon whether the response received seems to warrant the amount of work and expense involved in maintaining this free service to all amateurs. If you take advantage of this service, please acknowledge that you are doing so by notifying the Experimenters' Section, A.R.R.L., 1711 Park Street, Hartford, Conn. You may use ordinary stationery or special blanks that may be obtained from the above address. A goodly number of these blanks has been gathered and as the number grows we will gradually gain a unique and accurate record of transmission phenomena possible with no other station.

SCHEDULES

(Figures are frequencies in MEGACYCLES per second; approximate wavelength is given in parentheses.)

(Continued on Page 32)

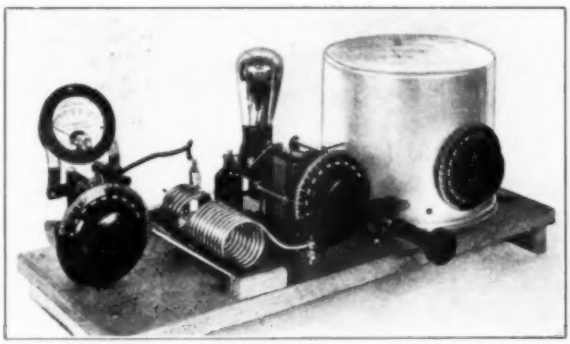
The Oscillator-Amplifier Transmitter

A Practical Study of Its Suitability for 1929 Operation

By Ross A. Hull*

The first activities on the A.R.R.L. Technical Development Program, in the examination of 1929 difficulties, have been studies of the possible methods of adapting present-day transmitters for 1929 service. The first resulting article, reporting the work on self-excited transmitters, appeared in the August, *QST*. The second phase of the work has been on master-oscillator-amplifier transmitters. In this article Mr. Hull, the director of the program, presents the results of this examination. Here is a real "1929 transmitter."—Editor.

DURING the last two years, in particular, master-oscillator-amplifier transmitters have been given brilliant and comprehensive treatment in *QST*. A study of the articles included in the appended bibliography would provide the amateur not only with a splendid idea of the operation of these circuits, but also with complete constructional details of several types of practical transmitters. In view of the existence of this material, we do not propose to treat the history of the circuits, the theory of their operation or even the reasons behind their peculiar effectiveness, unless such treatment is involved in the consideration of their application to the solution of next year's problems. The objectives in our examination of master-oscillator-amplifier transmitters were to study the conventional circuits; to build one into a transmitter in the way that the average amateur would build it; to tune it with the care that the average amateur would take, and then to measure its performance. In this way we hoped to be able to gain some idea of the relative desirability of oscillator-amplifier and self-excited circuits in a general way. Our objectives included also the construction of a somewhat refined transmitter; the precise tuning of its circuits, and the measurement of what would then be something approaching the best possible performance that could be expected under normal conditions. These are the matters, therefore, to which we will give our attention.



A LOW-POWERED OSCILLATOR-AMPLIFIER TRANSMITTER WITH A "1929 TYPE" PERFORMANCE

The frequency being set by a High-C oscillator within the aluminum container, and the amplifier being accurately neutralized, the antenna can be shaken to the ground and the frequency will remain practically constant. Differing from crystal-control practice, the oscillator is a tube similar to the amplifier operated well below its rating.

"OSCILLATOR-OSCILLATOR" TRANSMITTER

We recall, five or six years ago, the construction of an elaborate master-oscillator-amplifier transmitter. We knew that such a transmitter would give steady signals of splendid character, and as a result we were not surprised to obtain some excellent reports during the first few QSO's. We recall as well, however, that shortly afterwards, the transmitter was started up with the oscillator accidentally disconnected. Behold! The antenna current was there just the same. Eventually, we were able to tune the thing properly but we were surprised to find that with the slightest misadjustment the performance would drop to that of a self-excited transmitter. Since that time, the development of effective neutralizing systems has simplified the tuning business very greatly. It must be understood at the start that even in these enlightened days the use of a master-oscillator-amplifier transmitter does not spell the end of swinging and creeping frequencies—that its use does not in any way eliminate the necessity of careful and exact tuning.

The first transmitter built in the Laboratory for this study consisted of a UX-171 oscillator using the Colpitts circuit, and supplied from 135 volts of "B" bat-

*Associate Technical Editor, *QST*. In charge A.R.R.L. Technical Development Program.

tery, driving a UX-210 amplifier powered by a 550-volt generator. It was, as our objective dictated, an average transmitter, built and tuned without any particular care. The oscillator was tuned to take 30 m.a. and the amplifier bias was adjusted until a plate current of 70 m.a. was obtained in normal operation. The amplifier was neutralized with its plate supply disconnected by adjusting the neutralizing condenser until no energy could be found in the amplifier tank with an indicating wavemeter. At this time, we switched on the "Growler" and listened. To our surprise we found that the note was poor, that the frequency was creeping badly and that it responded to even slight vibration of the antenna. Further tuning adjustment was made with some considerable improvement in performance but it was not found possible to obtain the same efficiency in the amplifier as that obtained in the self-excited oscillator described in last month's *QST*. Plotting of the antenna-tuning-vs.-frequency characteristics showed that it was considerably better than that of the self-excited transmitter but on the other hand the plate-voltage-vs.-frequency curve was extremely poor. An increase of the oscillator plate voltage to 300 resulted in an enormous improvement of the amplifier efficiency and measurement showed us that we had far surpassed the self-excited set in this regard. Under these conditions, however, the frequency creep was as much as 10 kc. per minute and the oscillator was therefore run alone until the cause of the trouble was found. A process of elimination placed the responsibility on the small fixed "bridge" condensers used across the oscillator inductance, which apparently were heating sufficiently to change their capacity appreciably. The replacement of these condensers with others of the air-

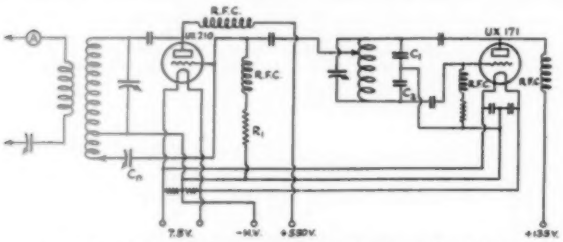
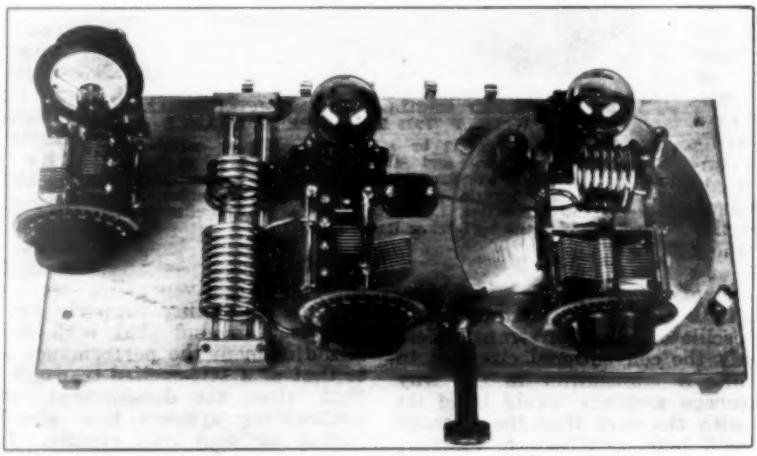


FIG. 1. THE CIRCUIT USED FOR PRELIMINARY EXPERIMENT

Heating of the fixed condensers C1 and C2 in the High-C oscillator tank caused serious creeping. Their use was avoided in the second transmitter by the employment of the Hartley circuit for the oscillator. Additional turns outside the amplifier plate tank were found necessary to make the neutralizing condenser Cn effective and for this reason the simple neutralizing scheme shown in Fig. 2 was adopted. The grid leak R1 in place of a bias battery proved dangerous in practice, the amplifier plate current rising to enormous values when the oscillator was detuned or when the amplifier grid excitation was removed in some other manner.



THE TRANSMITTER WITH THE OSCILLATOR SHIELD REMOVED

Mounted on an aluminum disk is the Hartley oscillator with a High-C tank. Over it fits the aluminum kettle. The amplifier unit, with a relatively Low-C plate tank, is mounted alongside the oscillator and between it and the antenna tuning unit. Glass rods are used to support the amplifier plate coil and the antenna coil, coupling between them being varied by sliding the latter along the rods. The neutralizing condenser—probably the most important control in the transmitter—is mounted between the oscillator and amplifier tuning condensers.

dielectric type or the change to a Hartley circuit, fitted with an ordinary variable condenser, immediately reduced the creepage to a low figure. The use of a UX-210 in place of the UX-171 resulted in still further improvement.

MORE TROUBLES

Other weaknesses in the performance were frequency wobbles due to vibration of the inductances and wiring, and violent frequency swings resulting from movements of the operator in the vicinity of the set. All of these matters were given consideration in the design and construction of the second master-oscillator-amplifier transmitter pictured and described on these pages. Summing up our experiences we decided that the term, "master-oscillator-amplifier" is not the synonym for constant frequency that it is so often thought to be —that the system is capable of producing extremely satisfactory signals, but that tuning plays just as much or more of a part than in the case of self-excited outfits.

In the second transmitter, a UX-210 was used as the oscillator in a Hartley circuit, so avoiding the necessity of fixed "bridge" condensers. The mounting of the inductance and the wiring were made more substantial and the unit was assembled on an aluminum disk over which an ordinary aluminum kettle could be inverted. The shield, so provided, was not intended to prevent undesired couplings between the oscillator and amplifier but merely to avoid the frequency changes due to body capacity variations. It proved thoroughly effective for this purpose though it was found necessary to drill holes around the bottom edge and at the top to provide ventilation. Before these holes were drilled serious frequency creeping was caused by the heating of the apparatus within the kettle.

THE OSCILLATOR TANK

A High-C tank was used for the oscillator, the values of inductance and capacity being of the order of those found desirable in our previous study of self-excited oscillators. The low power of the oscillator, however, made it possible to use inductances of 3/16" outside diameter copper tubing. With input power to the oscillator of 10 or 12 watts it was not found necessary to use heavier conductor or more effective contact than that provided by the plugs and sockets shown in the photographs.

The amplifier, consisting of another UX-210 arranged in a conventional circuit, was mounted with its associate apparatus in a group just clear of the oscillator. In the plate circuit of this tube a High-C tank was avoided in order to permit a high degree of efficiency without the necessity of any particular refinement of its construc-

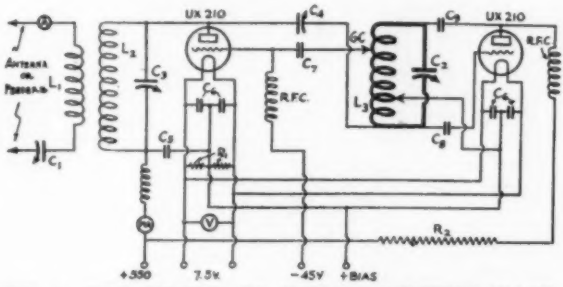


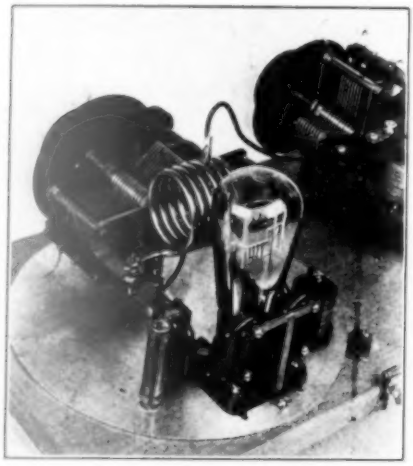
FIG. 2. THE CIRCUIT OF THE TRANSMITTER ILLUSTRATED ON THESE PAGES

C1, C2—500-μμfd. receiver type variable condensers.
C3—350-μμfd. ditto.
C4—50-μμfd. midget condenser.
C5—2000-μμfd. fixed by-pass condenser.
C6—1000-μμfd. filament by-pass condensers.
C7—250-μμfd. coupling condenser.
C8—250-μμfd. fixed oscillator grid condenser.
C9—1000 μμfd. oscillator stopping condenser.
R1—Center tap resistors—50-or 100-ohm resistors or Christmas tree lamps.
R2—100-watt, 10,000-ohm grid leak used to drop plate voltage for oscillator.
R.F.C.—Three sections each of 50 turns of 30 gauge d.c.c. wire wound in ¼" plots in a 1" former and connected in series. The usual tubular chokes should be equally satisfactory.
L1, L2 and L3 are illustrated and described elsewhere. Various keying methods were used satisfactorily though their relative effectiveness has not, as yet, been studied. For the time being, we suggest that one of the many effective schemes which has been described in *QST* be employed. The adjustment of the grid clip GC will not be found critical. Satisfactory operation probably will be obtained with one-quarter of the total turns between GC and the plate but experiment with other adjustments is desirable.

tion. In the case of a correctly neutralized amplifier tube, slight changes in the tube constants due to changes in the load or heating of the tube should have negligible effect on its performance and it is on account of this fact that a High-C amplifier plate tank is not particularly desirable. With amplifier plate inductances of the sizes shown in the photograph, the tank currents were not high enough to justify the use of heavier conductor than that used in the oscillator, nor the use of more elaborate connectors. In the antenna circuit, still lower currents are found and the same conductor was entirely suitable.

In this second transmitter, a change was made in the neutralizing method (as can be seen by a comparison of Figs. 1 and 2) since it was found possible in the second method to avoid the necessity of turns additional to those included in the tank cir-

cuit. This change, of course, considerably simplified the arrangement of the tank. The construction of the transmitter is quite conventional in all other respects and it



A "CLOSE-UP" OF THE OSCILLATOR UNIT

On the left of the tube is the grid leak and the grid condenser from which the combined connecting strip and coil mount is run to the variable condenser. A similar arrangement is used on the plate side of the tube. On the right side of the tube is the plate r.f. choke. The filament by-pass condensers can be seen mounted on the tube base in the immediate foreground.

should not be necessary to add to the information provided by the illustrations and diagrams.

THE ULTIMATE PERFORMANCE

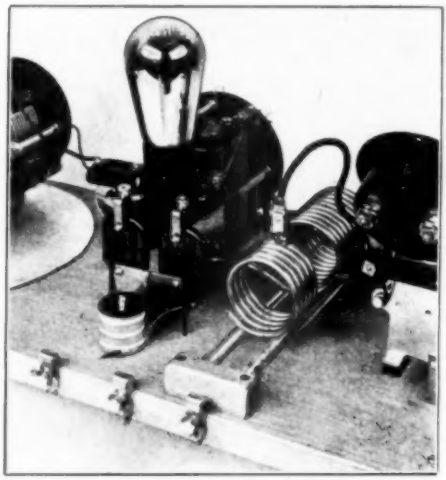
We admit that the transmitter is a dizzy looking contraption but we must say that its performance was something very close to our idea of perfection, as soon as we had mastered its tuning. It could be left running with an automatic key for a couple of hours (monitored with a crystal oscillator) without a frequency drift of any serious proportion; it could have its plate voltage (both oscillator and amplifier) varied 10% with a frequency change that was only just observable; it could be "walked all over" with both hands without the monitor noticing it; it could give us a "pure musical d.c. note" with the simplest filter.

It performed so splendidly, as a matter of fact, that we dreamed that night of a world filled with master-oscillator-amplifier transmitters and Bourne acoustic filters. Truly it was a world of bliss!

But we cannot leave those statements without placing in juxtaposition the claims that tuning is even more important in master-oscillator-amplifier transmitters than in the self-excited sets and that the use of a monitor or "Growler" for the work is of equivalent consequence.

THE TUNING PROCESS

In tuning the oscillator the same procedure will apply as that outlined for any self-excited transmitter. In tuning this oscillator with the aid of a monitor, we found it desirable to do the work with the plate supply filter disconnected. In this way it was more readily possible to decide upon



THE AMPLIFIER UNIT IN GREATER DETAIL

The height not being limited by any shield, the tube, in this case, is mounted in a convenient position on brackets extending from the tuning condenser. Under the tube base is the plate circuit by-pass condenser and dropped from it is the filament by-pass unit. Projecting to the left of the tube is the grid coupling condenser in the lead from the oscillator.

the adjustments giving the cleanest note than when a well-filtered plate supply was used. In the adjustment of this particular transmitter, the generator was run without any filter and the adjustment was considered satisfactory when the modulation of the note due to plate supply ripple had been reduced to the point where it could just be detected.

While tuning the oscillator, it is well to have the grid lead to the amplifier attached, but the amplifier should be run with its plate supply disconnected. Just as soon as the oscillator has been adjusted to give the cleanest and steadiest signal on the required frequency, with the input at about 10 watts, the preliminary neutralizing can then be undertaken. For this work, a two-turn coil connected to a flash lamp bulb should be coupled closely to the amplifier plate coil, and with the neutralizing condenser set at zero, the plate tuning condenser rotated until the maximum indication is obtained in the bulb. At this stage,

the neutralizing condenser should be adjusted until no such indication is obtained even after a slight readjustment has been made with the amplifier plate tuning condenser. The plate voltage to the amplifier can now be connected (the grid bias being at about 45 volts) and slight retuning of the amplifier plate tank can be made to reduce the amplifier plate current to the lowest value. Antenna coupling and tuning can now be effected, keeping in mind the fact that antenna coupling still plays the same important part in master-oscillator-amplifier transmitters as far as efficiency is concerned, and that it still has some influence over the performance as far as frequency stability is concerned. In short, when the coupling has been adjusted until maximum antenna or feeder current has been obtained, the coupling should be backed off until the antenna current is about 85% of its former value. Unlike the self-excited transmitters no noticeable improvement was effected by detuning the antenna and any sacrifice of antenna current other than that resulting from the loose coupling was not considered necessary.

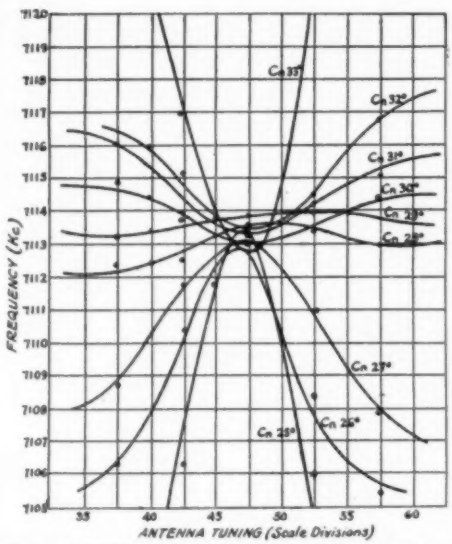
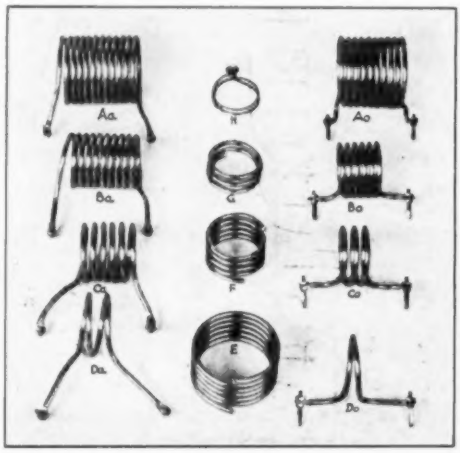


FIG. 3. SHOWING THE EXTREME IMPORTANCE OF PRECISE NEUTRALIZATION

In taking these curves the neutralizing capacity Cn was set at various values, denoted ,for convenience, by the dial readings. At each adjustment the Antenna-tuning-vs.- Frequency curve was plotted. It can be seen from curves Cn 27 or Cn 32 that misadjustments of two or three degrees on a 500 μμfd. condenser can lower the performance almost to that of a self-excited transmitter. The correct adjustment in this particular case was somewhere between 29 and 30 degrees. With Cn at 29 the frequency swing was slightly upward while at 30 it was downward. If Cn could have been adjusted to about 29.3 the frequence change caused by tuning the antenna through resonance probably would have been not more than a few cycles and antenna swinging would then have had practically no influence on the frequency.

If the tuning has been followed in the monitor, the signal will probably be clean and extremely steady, but attention should be reverted to the neutralizing condenser for final adjustment. By listening to the transmitter with little or no plate-supply filter a magnificinet final adjustment of neutralizing can be made. As the attainment of complete neutralization is approached, the character of the note will improve greatly, and at the exact point of neutralization it will be far superior to that obtained on either side. The point at which the note clears is, indeed, so well defined that we are now of the opinion that much more exact adjustment of neutralizing can be obtained by checking with the monitor than with any method so far attempted. We admit, however, that the method previously mentioned (or a similar one) is indispensable in providing the approximate adjustment, since the monitor method can be put into use only when the transmitter is operating in a somewhat normal fashion. In all of our experimental work we found



OSCILLATOR, AMPLIFIER AND ANTENNA COILS FOR FOUR BANDS

Made of 3/16" outside diameter copper tubing and wound by hand on a piece of iron pipe these coils serve for the four bands from 3,500 to 14,400 kc. in this particular transmitter. In a transmitter arranged differently some changes in the dimensions given may be necessary. Coils Aa and Ao are the amplifier and oscillator coils for the 3,500 kc. band. They have an internal diameter of 2½". Coils Ba and Bo are for the 7000 kc. band, Ca and Co for 14000 kc., and Da, Do for 28,000 kc. For the last three bands the coils are wound to have an inside diameter of 1¾". Coil E is used in the antenna circuit for 3500 kc., F for 7000 and 14000 kc. and G for 28000 kc. The number of turns used can be seen on the illustration. Coil H, fitted with a flash-lamp bulb, is that used for the preliminary neutralizing process.

that the adjustment of neutralizing was of extreme importance . In every case, it can be said without exaggeration, a 10-degree movement of the 50-μμfd. neutralizing

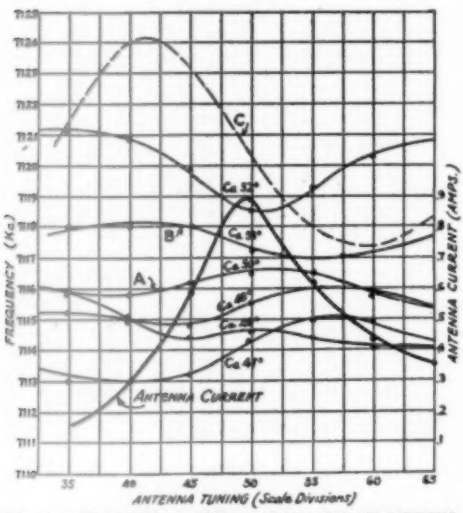


FIG. 4. GRAPHICAL INDICATION THAT DETUNING OF THE AMPLIFIER PLATE TANK ACTUALLY IMPAIRS PERFORMANCE

In this case the amplifier plate tank capacity Ca was set at various values and an Antenna-tuning-vs.-Frequency curve plotted for each. In Curve A the tank capacity was slightly below that required for resonance at the oscillator frequency, and the frequency swing was upward. In Curve B, taken with a condenser setting one degree higher, resonance clearly had then passed and the frequency swing was downward. It appears from the curves that a setting between 50 and 51 degrees would have produced that desirable condition in which antenna tuning has no appreciable effect on frequency. The dark curve is given to denote the antenna tuning adjustment at which the antenna circuit was in resonance with the amplifier plate tank. The dashed curve C was taken with the low-powered self-excited transmitter described in the August *QST*. It is given to provide a comparison of the performance of the two transmitters.

condenser spelled the difference between a 1928 and a 1929 type signal.

TRANSMITTERS OF HIGHER POWER

While the time set apart for this study of present-day master-oscillator-amplifier transmitters did not permit the construction of a higher-powered transmitter, we can see no reason why the same general ideals should not hold good. The choice of the oscillator and amplifier tubes will be a matter of greatest importance for it is certain, in our minds, that the complications involved in a master oscillator will not be justified unless the input of the oscillator, operating at normal efficiency, is at least one sixth of the ampliefir input—the two tubes working on the same frequency—and unless the oscillator is being run well under its rating. This means that a UV-203-A or a UX-852 would be the only tubes suited for use as an oscillator controlling a tube of the latter type, while a UX-852 would be required to control a UV-204-A. It is not claimed, of course, that these combinations alone would prove satisfactory. It is merely suggested that under average conditions they would be very desirable.

In case this statement of master-oscillator and amplifier ratings would not appear to be checked by general crystal-control practice, it might be well to explain that conditions in the two instances are not by any means parallel. In the crystal-control transmitter the work of the oscillator is merely to supply sufficient excitation for the succeeding amplifier tube. In the case of the master oscillator (the term is used on account of its convenience but they are really both master oscillators) its work is to supply the amplifier excitation in a similar manner but to do the work without changing its frequency in accordance with any minor fluctuations of the load on it. In the crystal oscillator the crystal takes care of any such changes but in the master oscillator a stable frequency can be obtained in a practical manner only by making the energy drawn from it for amplifier excitation a fraction of the total radio frequency energy being developed.

We like the master-oscillator-amplifier transmitter. Its complications are minor; its tuning is straightforward; its performance, we'll tell the cross-eyed world is wellnigh supreme.

Recent *QST* articles treating the Oscillator-Amplifier Transmitter:

Master Oscillators and Power Amplifiers (Kruse) March, 1927

A Constant Frequency Transmitter (Hoffman) July, 1927

A Low-Power Master-Oscillator Transmitter (Dudley) Feb., 1928

Keying Master-Oscillator Circuits (Dudley) April, 1928

THE ONLY U.S. HAM WHO NEVER HRD A FOREIGN STATION

Radiovision

By Thornton P. Dewhirst*

OF LATE there has been considerable publicity concerning radiovision or television and the reception of such signals by the amateur and experimenter. There has been but little information in a form suitable for the amateur and it is the object of this article to give some pointers on the problem and show some of the limitations of the art in its existing state.

First of all, do not expect too much from your radiovision investment. A picture of only slight detail is possible when reception is to be accomplished on the present broadcast set and the transmitter is to stay within the ordinary assigned channels of today. The use of present-day channels limits the number of lines drawn per picture to approximately 24. This means that the bust of a single person is about the limit of recognizable reproduction in half tone work and that possibly two moving figures in silhouette may be accomplished at the most. However, let us go into detail about the apparatus proper and return to this phase of the subject when we have acquired a little more data concerning the methods of transmission and reception.

By means of a revolving disc at the transmitter, the object is scanned by a spot of light, the reflection of which is picked up by a bank of photo-electric cells and these electrical impulses so generated are used to modulate the carrier wave. At the receiving end we have another disc revolving in synchronism and the radio signal is employed to illuminate a lamp which is viewed through the disc. The number of holes in the disc will determine the number of lines per picture and the speed of the disc will determine the number of pictures transmitted each second; both of these factors are set by the transmitter.

In the case of the 24-line picture as transmitted by WGY, there is not much that need be said. These pictures may be received on the standard broadcast receiver providing a good audio-frequency amplifier is being used and the radio frequency end is such that the full 10-kc. band is passed.

For reception of the 48-line pictures, the story is quite a bit different. Unless your present receiver uses a tuned r.f. amplifier with separate controls for each stage, and the audio amplifier will pass an extremely wide range of frequencies, it will be necessary to use a specially constructed set.

Let us take the case of a 24-line picture. Consider that each line is divided up into 24 separate elementary portions which means that for the whole picture we have 24×24 or 576 elementary areas that are being scanned by the beam of light. Now, if 20 pictures are being sent each second, each elementary area giving a large change in illumination compared with its

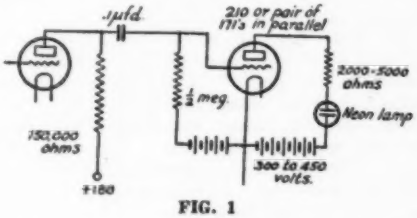


FIG. 1

immediate neighbors, the maximum frequency being transmitted will be $576 \times 20 = 11{,}520$ impulses per second. These impulses are uni-directional and two pulses would be equivalent to one cycle, which means that the equivalent frequency is half of this value or 5,760 cycles per second. In actual transmission of half tones, the change of illumination will not occur abruptly nor will there be a change for each elementary area. This results in the highest frequency being still further lowered so that if the amplifier will pass frequencies up to 5000 cycles, it will be satisfactory for the job. When silhouettes are being transmitted, the changes in illumination are apt to be more rapid and abrupt, resulting in a larger band of frequencies that must be passed by the system. To compensate for this, when receiving (or transmitting) silhouettes, the amplifier does not have to have as excellent frequency response characteristics as when half tones are being received, because in silhouettes we are interested in but two values of illumination, light and dark; whereas in half tones, the various shades between these values must be considered.

A 36-line picture sent 10 times per second will require a band but slightly wider than the 24-line, 20-per-second transmission. However, since the number of times a second a picture must be repeated in order that the phenomenon of persistence of vision be obtained is also a function of the intensity of the illumination, it can be appreciated that in order to obtain a steady smooth image using the above speed, a light source of considerable intrinsic brilliancy will be required. The stronger the

*Radio Consultant, 4909 7th Street, N. W., Washington, D. C.

light, the fewer pictures per second necessary to obtain persistence of vision providing the speed is not reduced to a point where flicker is introduced. About 15 pictures per second is the slowest speed advisable.

A 48-line picture sent 15 times per second will require about 20 kcs. for each side band or about four present-day channels. For this work, receivers must differ considerably from those employed for present-day broadcast reception. One stunt is to use four channels for this transmission, splitting the picture up into four parts, each of which is handled by a separate transmitter and receiver.

The best type of audio amplifier for the job will be a resistance-coupled affair. High mu tubes of the "240 type" may be employed and the plate resistors should be of about 150,000 ohms (somewhere between 100,000 and 250,000 ohms will be about right), the coupling condenser around .1 μfd. and the grid leak, ½ megohms. These last two may be changed somewhat although it must be remembered that as the coupling condenser is made larger, the grid leak resistance must be reduced. If the condenser is too small, the low frequencies will not be amplified while if it is too large, the size will have to be reduced to a point where the amplification of all frequencies is lowered or the tube blocks. About 180 volts of B-battery will be needed for the amplifier.

In a stage of resistance-coupled amplification, the output signal is approximately 180 degrees out of phase in relation to the input signal. The number of stages needed does not then depend only upon the amount of gain necessary but also upon the fact that the image is to be a positive and not a negative one. Whether there shall be an odd or even number of stages will depend upon whether the transmission is of a negative or positive picture. When the correct number of stages has been found for a given transmission so that the picture received is a positive one, additional stages must be added in pairs so as to retain this phase relation. The grid bias should be adjusted with care. When receiving half tone pictures, adjust as for phone signals while if silhouettes are to be received, the bias should be slightly increased.

The use of the grid bias method of detection is to be recommended in preference to the leak and condenser system. While the sensitivity will be reduced, the amount of distortion will also be reduced, resulting in more satisfactory operation. Changing from one type of detection to the other will also cause a shift in the phase relation of the output. An r.f. choke may be needed between the plate circuit of the detector and the grid circuit of the first amplifier to prevent the r.f. that gets by the detector from loading up the audio amplifier.

The neon lamp should have a plate or target that is as large as the picture we wish to reproduce. This is necessary since we want to look directly at the lamp through the holes in the disc. The use of small lamps is not recommended as there is considerable improvement in the use of a lamp with a plate or target of ample proportions (about 1½ inches square). These may be readily obtained and are well worth the additional expense entailed. It is connected in the plate circuit of the last stage of the amplifier. This stage may consist of a 210 or a pair of 171's in parallel. See Figure 1.

The resistance of the lamp before it is ignited is infinite but after it has been ignited, its resistance is quite low, varying from several thousand to ten or twenty thousand ohms depending upon the amount of current passing through it. The voltage drop across the lamp is constant, its resistance varying in inverse proportion to the current flowing through it while the illumination is proportional to the current flow. In testing a lamp by connecting it across a battery, a.c. line, etcetera, it is essential that a resistance of a few thousand ohms be connected in the circuit or the target is liable to volatilize and render the lamp inoperative for this particular type of work. The resistor will control the amount of current that can flow and prevent this sort of breakdown.

The radio frequency amplifier offers more of a problem than does the audio system. When the width of the side bands is not much greater than the present day broadcast channels, it is possible to take a tuned radio frequency amplifier (the stages being tunable separately) and by adjusting the circuits slightly off tune with each other, the width of the band can be increased although the gain is reduced.

A step further in this line is the method described by Dr. F. K. Vreeland in his paper which appeared in the March, 1928, issue of the Proceedings of the Institute of Radio Engineers. He uses two tuned circuits loosely coupled by either an inductance or capacitance so as to resolve all the resonance curves into one with flat top and steep sides. It is in effect an adjustable band-pass filter. Such filters may be used either before or after the untuned amplifier stages or they may be employed as the coupling devices between the amplifier tubes.

One may also use a double-detection receiver (superhet) and insert a fixed band-pass filter between the first detector and first intermediate frequency amplifier or

the filter may be inserted somewhere between that point and the second detector.

Synchronization is a problem of considerable magnitude and has not been solved to date. There have been many solutions offered but in the majority of cases, they have been too expensive for general adaption. Present practise is to use a series or shunt wound motor and by means of a resistor in the field circuit or in series with the line, adjust the speed to the desired value.

To determine the required speed, multiply the number of pictures per second by sixty, the product being in r.p.m. If you already have a revolution counter it will help you arrive at approximately the correct speed although if you have not one, it is not necessary to get one as after several trials you will find the approximate settings of the resistors for a given speed. Assuming everything else in working shape, as you approach the correct speed, the image will appear, although in distorted shape. If the image is continuously traveling up or down it indicates that either the speed is incorrect or not constant. If the image remains stationary but is not properly framed, the receiving disc is out of phase with the transmitting disc. This may be corrected by moving the lamp to a different part of the disc, dropping the motor speed a fraction of a revolution if possible or rotating the field of the motor.

The size of the disc depends upon the number of holes and the width of the picture. The distance between the outermost hole and the center may be calculated by the following:

$$\text{distance} = \frac{\text{number of holes X width of picture}}{2\pi}$$

$$\text{size of holes} = \frac{\text{height of picture}}{\text{number of holes}}$$

For best results the size of the picture should be determined by the size of the target in the neon lamp. Assuming a 1½ inch square target, a 24-line picture requires a disc with a radius of approximately six inches while a 48-line picture would call for a twelve inch radius.

In laying out the spiral one can make use of a piece of drill rod or dowell, the circumference of which is the same as the height of the picture. By placing it at the center of the disc with a piece of string or wire tied firmly to it, a marker fastened to this string about ¼" from the edge of the disc will inscribe the desired spiral as it is rotated about the center. In speaking of the spiral one might refer to the distance between holes as the separation of the holes and the height of the picture or distance between the first line and the last line as the offset of the spiral.

When using the disc method of transmission very little in the way of refinement seems possible due to the huge size of the disc if better pictures are to be achieved. Mechanical improvements must be made

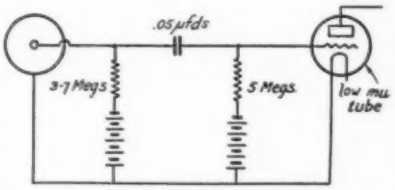


FIG. 2

and one method patented by Ramsey is to continue the spiral on around gradually approaching the center of the disc. Each complete turn of the spiral has its own lamp which in turn is operated from a separate transmitting channel or a switch is provided to light the individual lamps in succession. This produces a larger picture than a given disc could normally accommodate. If the spiral is of two complete turns, the separation of the holes will be twice the spiral offset and two lamps will be needed. The switching device causes irregularities in contact which is important in half tone work and the sparking produced causes radio interference to the receiver. This may be partially reduced by switching ahead of the output tube and providing an output tube for each lamp.

Jenkins uses a number of helices drilled in a cylinder, each helix being illuminated by an individual target in a multi-target lamp similar to the manner in which Ramsey illuminates several spirals on a disc. Jenkins places the multi-target lamp at the center of the cylinder and by the use of quartz rods conducts the light to the periphery of the cylinder with very little loss. The individual targets of the lamp are small and thus a given amount of energy will produce a large amount of illumination. It is confronted with the same drawbacks as regards switching as is the Ramsey system.

Ramsey's method produced a gradual narrowing of the width of the image as the spiral approaches the center of the disc while the other produces a fading out of the image at the edges. The first may be corrected by proper framing and providing that care is exercised at the transmitter, no distortion will be caused. In

the cylinder method, a lens will correct the difficulty to some extent.

The disc can be used for both transmitting and receiving at the same time by continuing the spiral a quarter turn more. For a 24-line picture, lay out six more

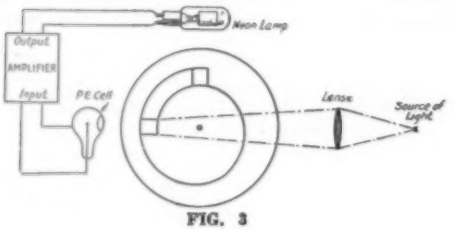


FIG. 3

holes after the full spiral has been made and for the 48-line disc there should be twelve additional holes. The picture is to be received one quarter of the circumference from the point where it is transmitted. A photo-electric cell (abbreviated P.E.) a light source and a few more stages of amplification will be needed. The number needed will depend upon the number of lines to the picture and the intensity of the light source. At least a 500-watt lamp on arc light should be employed. The arc should not be run from an alternating current source as the variations due to the a.c. (even 60 cycles) which are relatively slow will modulate the signal and cause trouble.

The connections to the P.E. cell are shown in Fig. 2. The resistance in series with the cell will vary between three and seven megs. It has been found advisable to use a low mu tube as the input tube which may be followed by high mu tubes in the rest of the amplifier. It would perhaps be best to start with silhouettes since then the P.E. cell may be adjusted at a value where the voltage is just below the point causing the cell to glow when the strongest light is on it for the longest time necessary. For half tone work, the cell must be worked down on its characteristic curve where a linear relationship exists between illumination and response. Under these conditions more amplification will be needed. Figure 3 shows the general arrangement for transmitting and receiving on the same disc. Try placing a key, small screw driver, fingers, etcetera in the lighted area and see the outline of these objects in the receiving area. Next, a photographic film, preferably a positive, may be tried.

After this has grown to be "old stuff" one can try putting the signal on a carrier wave to be picked up at a distance. With the 24-line picture the transmitter may be any *good* phone set. However, it must be good and there should be no a.c. hum in the carrier and the complete audio spectrum to about 5000 cycles should be transmitted without much distortion. Few of the present-day amateur phones will pass this test and the first step toward this type of transmission should be a thorough housecleaning of the phone set. It is useless to attempt the work with a poor transmitter.

The disc with the extra holes may be used and the receiving area employed for monitoring the signal. After you have done satisfactory work with the 24-line pictures, you can try transmitting a 36- or 48-line one. This transmission and reception problem should keep you employed for some time.

The use of the cathode ray tube for the receiver is worthy of consideration since it opens up the possibility of real radiovision. In this tube, a stream of electrons may be moved in two directions at right angles to each other by means of either an electric field or a magnetic field. The window of the tube is covered with a fluorescent material and the electrons upon striking it cause it to glow. By means of proper values of current or voltage and frequency, the small spot of light can be made to completely cover the window. For radiovision work, the use of a material for coating the window that was not only flourescent (emits light when exposed to certain rays) but also continues to glow for a short period after the ray has been removed would be of material assistance. This will help in causing the vision to persist and thus give the effect of greater illumination as far as this characteristic is concerned.

Radiovision for the home is still in the very distant future and this constant hoodwinking of the public should cease. The radio industry will benefit enormously when it does. When the elementary area used to build up our picture bears the same proportion to the whole picture that the individual particles of the emulsion of the moving picture bears to the total number of particles in the exposure and some method of transmitting each of the individual parts with ease and the problem of synchronism has been completely and simply solved, radiovision will be ready for the public. Today it is merely a plaything for the amateur and experimenter. It is an interesting field of experiment but one should not expect too much from his present day equipment.

Strays

A certain ingenious fifth district amateur has trained his parrot to yell "CQ". He had an automatic CQ disk for his telegraph transmitter but his 'phone set was wanting

We Ought to Talk Frequency

The Reasons Why, Including a Look at Our 1929 Bands

IT is time that amateur radio thought and spoke in terms of kilocycles instead of wavelength in meters. All of the rest of the world has changed. By the terms of the Washington Convention of 1927 the primary standard in all assignments to radio stations is to be frequency, and it will be in terms of frequency that all of our amateur assignments are made. The term wavelength is such an inconvenient one, and so far-fetched as far as concerns the physical appearance of anything in a station, that it seems the sooner we forget all about it the easier it will be for us to figure things out. Electricity in general got off on the wrong foot a good many years ago when it started talking about a current flowing from positive to negative, only to discover in more recent years that the motion which occurs is that of electrons moving from what we call negative to what we call positive. Everybody knows how much trouble that dual conception has caused. It seems to us that this business of wavelength in meters is equally left-handed.

There are a number of excellent reasons why the International Radiotelegraph Conference decided to express its allocations in terms of frequency instead of wavelength, and numerous very excellent reasons why we amateurs must now convert ourselves into thinking in terms of kilocycles. Let us examine a few of these reasons.

In the first place, talk about wavelength is "the bunk" because it is a thing that cannot very well be measured. When we talk about the length of our radiated waves we mean, for example, that if we had an oscillator going at about 7,500,000 cycles per second, and coupled to an antenna, and then if, Joshua-like, we could command those waves to stand still, and then if we could see them, and then if we had a nice steel tape-line whose accuracy we could rely absolutely upon, and then if we measured these waves and found that it were 131 feet and 3 inches from a point in one wave to exactly a similar point in another wave, then our transmitter would be operating upon approximately 40 meters! Now we can't see the waves, and we can't stop them and have the same conditions that apply when they are radiating, and we can't rely too much upon our measuring sticks. The one thing that the world does have absolutely accurately is time, and it also has the ability to count, and the one thing which may be said with precision about our circuit is the number of times per second which it oscillates. Is it not ridiculous that we continue to talk in terms evolved from as far around the bush as wavelength in meters?

It is perfectly easy to think in terms of frequency and to see why this is logical. Consider the simple oscillating circuit of Figure 1 and imagine that the condenser, C, has been charged by impressing a voltage across it. Seeking to equalize the difference

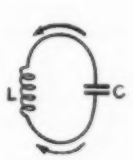


FIG. 1

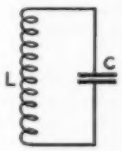


FIG. 2

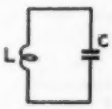


FIG. 3

in potential between the condenser plates, a current starts to flow, say in the direction of the heavy arrow. This current has to thread its way through the inductance, L, in which process it encounters electrical inertia because the inductance tends to prevent the flow of the current by taking up its power in the form of an electromagnetic field. Eventually all the power in the circuit exists in the form of these electromagnegtic lines of force around the coil, instead of in the form of electrostatic lines of force in the condenser, as had been the case an instant before, and current flow ceases. But when the current through the coil ceases, the field around it collapses and the energy is returned to the circuit to proceed and charge the condenser, and in fact this same quality of inertia in the inductance now gives the current a "push," so that the condenser instead of merely having its charge neutralized, is now charged in the reverse of its original direction. The current now starts back in the direction of the light arrow and the same performance occurs again, this action continuing until the power is reduced below a certain critical value by losses from heating or radiation. This is simply the customary story of oscillation in an LC circuit, as is related in any radio textbook.

Now the one thing which is perfectly obvious about this procedure is that if the inductance L is a large inductance like that in Figure 2 it will take the current a longer time to thread its way through the circuit, and if the capacity C, as in Figure 2, is a large condenser, it will take a longer time for it to become charged. "Electricity" having a constant velocity, it is immediately apparent that this circut is going to take a longer time to go through one complete

set of conditions (a cycle) than a circuit like Figure 3, in which both the inductance L and the capacity C are small. We have said in the past that the circuit of Figure 2 has a longer wavelength in meters than that of Figure 3 but we don't actually know how to express this left-handed measurement with any particular accuracy and the chief thing that we do know about Figure 2 is that it takes longer to oscillate, has a greater time-constant, oscillates more slowly, *has a lower frequency in cycles per second.* We can measure that because, from astronomy, we know exactly how long a second is. Is it not easier to deal with the more direct and obvious feature in the circuit, the rapidity with which it goes through its cycle?

Let us consider another example of the unreliability of attempting to deal in meters of wavelength. We say that the velocity of radio waves is 300,000 kilometers per second, the same as that of light. Obviously this velocity, divided by the frequency, should give the wavelength. Our circuit that oscillated 7,500,000 times per second comes out to have a wavelength of exactly 40 meters. And this is dead right *if* we know that the velocity is 300,000 kilometers per second. Unfortunately we don't know anything of the sort, even though that figure is frequently cited for this purpose. As a matter of fact, that figure is known to be somewhat incorrect and the latest scientific researches attribute to this figure the value of 299,820 kilometers per second. Our wavelength now turns out to be 39.98 meters! Which is right? Unfortunately we don't know. Some day science will set a still more accurate figure for the velocity of our waves, and then we will have still another measurement for our wavelength. All we can say to-day is that it is impossible for many small but dark reasons to give a wavelength accurately but that we are able to state our frequency with precision. For this reason the nations of the world have now agreed that the operating privilege to all radio stations will be stated primarily in terms of frequency, the approximate wavelength in meters to be stated as a secondary value, but with the frequency to be hewn to the line and letting the meters fall where they may.

There are other reasons why the terminology of wavelength is outgrown for us amateurs. Some of our 1929 bands are only a "meter" or so wide and any attempt to locate a wavelength within such bands is futile and meaningless unless it is carried out to the ten-thousandth part of a meter. It is easier to talk whole numbers in frequency. We know that we must learn greater precision for next year and that we must be able to recognize and discriminate between frequency differences of, say, 10,000 cycles (10 kilocycles) in our 40-meter band. Yet how can we deal in meters of wavelength with the two frequencies 7250 kilocycles and 7260 kilocycles when we think of them as being exactly the same thing, namely, "right around 41.3 meters"? Answer: we can't!

One more reason. Any intelligent examination of the capabilities of our various bands involves consideration of the number of stations which each will accommodate, which number varies with the frequency and in each case is to be expressed only in terms of width of channels, which again must be related to some percentage of the frequency. More about this later.

For these various reasons it is apparent that we amateurs ought now to abandon our outgrown wavelength nomenclature and get on the band-wagon and talk frequency. The standard way of doing this is to speak in terms of kilocycles per second, commonly called just kilocycles, and abbreviated "kc." A kilocycle is a thousand cycles, which is to say that the actual frequency of an oscillator is to be divided by 1,000 to give the frequency in kilocycles. For example, our 40-meter oscillator which we said oscillated 7,500,000 times per second has a frequency of 7,500 kilocycles per second or 7500 kc.

QST is going to lead the way in this. Frankly, we find ourselves unable to express 1929 thoughts lucidly in terms of wavelengths and we know that all of us simply must get around to talking frequency to be able to deal intelligently with next year's activities. *QST* therefore is going to talk frequency. We will follow such references with the approximate wavelength in meters, in parentheses, the wavelength being based on the velocity 300,000 kilometers per second. Since frequency is the primary standard and wavelength at best an approximation, the basing of the wavelength expression on 300,000 is near enough accurate and ever so much more convenient than the figure 299,820. That also is exactly the practice of the International Radiotelegraph Convention and of our own Federal Radio Commission and Radio Division, Department of Commerce. For the small sum of 5c (stamps not accepted) the Superintendent of Documents, Government Printing Office, Washington, will send you a copy of the "Kilocycle-Meter Convention Table," based on the figure 300,000, which was published on March 1st of this year. It is a large card, 13" by 23", containing 60 columns of figures, and its examination will provide a profitable pastime for nights when static is bad.

The Headquarters "gang" is now pretty generally thinking and talking in terms of kilocycles and we find it much more understandable and easy to deal with. The story is told that one of the later members of the Federal Radio Commission did not

know much about technical radio and, shortly before some extensive hearings were held, received some elementary instruction in the basic theory. Of course it was all in terms of kilocycles. At the hearings one of the speakers referred frequently to wavelength in meters. "What does he mean, wavelength?", said the member, leaning over towards a friend. "I never heard of it. Why doesn't he talk kilocycles?"

How much happier we'd all be if we had never heard of meters!

AMATEUR FREQUENCY BANDS
assigned by The Washington Convention of 1927

Kilocycles	Width in Kilocycles	Assignment	Approx. Meters on basis factor 3	Meters on basis factor 2.998	Harmonic family for centers of related portions		Amateur Purpose
					Kilocycles	Meters	
1715-2000	285	*Amateur, Mobile, point-to-point*	150 - 175	149.9 - 174.8	1775	168.92	*Domestic*
3500-4000	500	" "	75 - 85.7	74.96 - 85.66	3550	84.46	"
7000-7300	300	*Amateur Exclusively*	41.1 - 42.9	41.07 - 42.83	7100	42.23	*International Night*
14,000-14,400	400	" "	20.83 - 21.43	20.82 - 21.42	14,200	21.11	*International Day*
28,000-30,000	2000	*Amateur & Experimental*	10.00 - 10.71	9.99 - 10.71	28,400	10.56	*Experimental*
56,000-60,000	4000	" "	5.00 - 5.36	4.997 - 5.354	56,800	5.28	"

FIG. 4

A LOOK AT OUR 1929 BANDS

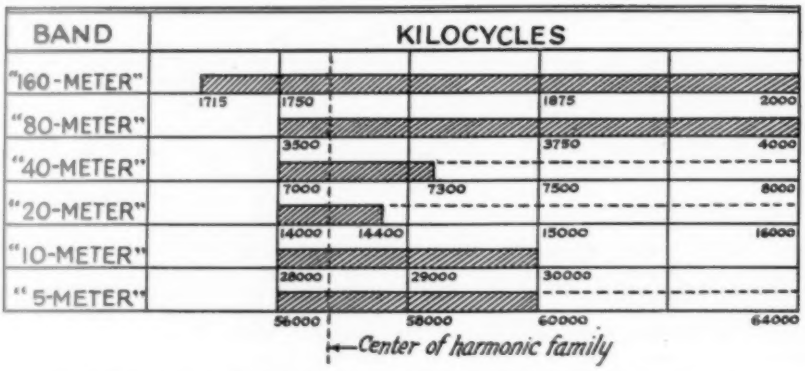
Let us now examine the bands which will be available for amateur radio after the end of this year. Figure 4 shows the assignments, the width of each band in kilocycles, and the approximate location of each band in terms of wavelength in meters.

From this table, which band would you say was the "widest"? If we speak in terms of the number of stations which can be accommodated in any band we get quite a jolt when we discover that neither that band 4,000 kc. wide nor the one 2,000 kc. wide is the "widest." Even the best adjusted station occupies a little slice out of the spectrum and this "slice" is to be expressed as a percentage of its operating frequency, so that as we get into a higher-frequency band we find that the width of the channel required for a single station is greater, and that a wider band will not necessarily accommodate more stations. Let us make some attempt to determine this "channel width." The Navy Department has calculated it out for the Federal Radio Commission on the basis of the 1929 assignments. It commences by assuming that each station might be permitted to deviate a certain small percentage on either side of its assigned frequency. Suppose the deviation is 0.1 percent; then let us assume that, in the commercial bands, there should be a space of one kilocycle on either side of this signal, to minimize the possibilities of interference. Understand that we amateurs aren't going to observe individual channels within our bands, but a consideration of the subject is useful in establishing the relative widths of our different bands. We find that on the basis just suggested the separation between channels in our "160-meter" band is 5.71 kc., 9.5 kc. in our "80-meter" band, 16.3 kc. in our "40-meter" band, 30.4 kc. in our "20-meter" band, and 60 kc. and 118 kc., respectively, in our two highest-frequency bands.

It is apparent that we need some new scale if we are to have an accurate gauge of the number of stations which can be accommodated in our various 1929 bands. This is supplied in Figure 5, which takes account of the fact that at double the frequency a signal occupies double the room in the spectrum. Now we are able to gauge the relative widths of our bands. We find that the "5-meter" and "10-meter" bands are the same in practical width, that the "20-meter" and "40-meter" bands are narrower than this but that our "80-meter" band is double this in width, and that our low-frequency band is our widest in point of number of stations that may be accommodated.

In Figure 5 the "40-meter, 20-meter and 5-meter" bands are shown extended by dotted lines to the extreme right-hand edge of the drawing. These are the former widths of

these bands, the territory which we are authorized to occupy during 1928, and thus the drawing shows graphically the extent of our losses at the Washington conference. There is a harmonic relation in this drawing. Any point on one line is the second harmonic of the point on the line immediately above it, the fourth harmonic of the corresponding point on the second line above it, etc. Thus our 1928 assignments were a true harmonic family, each higher-frequency band being of twice the width in kilocycles of the band which preceded it but each capable of accommodating the same number of stations, and with the additional feature, based upon the motto of the Third National Radio Conference that "Everybody should eat his own hash," that the harmonics of international agreement is that it is available for mobile, point-to-point and amateur services, but the present disposition of our Commission is to make no assignment in it other than amateur, considering the extent to which our high-frequency allocations have been clipped. We use the band chiefly for telephony, to which it is open throughout its extent. It is an excellent short-distance telegraphy band and our Communications Department is planning the expansion of this work as a beginner's wave. It will probably also be available soon for television and picture transmission experiments. It is to be noted that the portion 1715-1750 kc. has no harmonic relation to any of our other bands. The frequency in this band which is the center



SHOWING RELATIVE WIDTHS OF 1929 AMATEUR BANDS

FIG. 5

an amateur transmission could fall only within a higher-frequency amateur band. Only small portions of our 1929 bands are harmonically related to all of the others. The center of the harmonic portion is shown in figures in Figure 4 and is illustrated by the dotted line in Figure 5. From this it may be seen that if one wishes to have a crystal which, by harmonics, is capable of working in every amateur band, the crystal should have a frequency between 1750 kc. and 1800 kc. (166.7-171.4 meters); or, if the "160-meter" band is not desired, between 3500 kc. and 3600 kc. (83.3-85.7 meters).

We might now with profit look a little more carefully at each of our bands.

1750-kc. band. This band actually runs from 1715 to 2,000 kc. (175 to 150 meters). It contains about 60 commercial channels on the basis on which our Commission is now making commercial assignments. The of the harmonically-related portion is 1775 kc.

3500-kc. band. This is our well-known "80-meter" band, 3500 to 4,000 kc. (85.7 to 75 meters). This band remains the same in 1929 as it is today. That is fortunate for us, for this is our traffic wave, the heart of our Communications Department, the backbone of the League. Most of our organized operating activities take place on it, and by far the bulk of our domestic communications. The Navy rates it as containing 52 commercial channels. The harmonic center is at 3550 kc. Telephony is permitted between 3500 and 3550 kc. (85.7 and 84.5 meters). The international agreement on this band is also that it is available for amateur, mobile, and fixed services. But the Federal Radio Commission, impressed with the necessity for our retaining it if our organized communication is not to perish, has decided that no

commercial mobile or fixed assignments will be made therein in this country. We retain in this band our old arrangement of the last several years with the government services, whereby we share this band with low-power Army, mobile stations working in daylight hours during the field training season, and with Naval aircraft while operating off-shore. The President has assigned to the Navy sixteen frequencies within this band for the use of Naval aircraft. The Navy has used frequencies here for many years and has not bothered us, so there is no reason to suspect that this means any additional inconvenience for us.

7000-kc. band. This is our million-dollar band, the center of the rumpus at Washington last fall, the one where we acquired the heartache and lost our shirt to Europe and Canada. Originally 7,000 to 8,000 kc., it will read next year 7,000 to 7,300 kc. (42.86 to 41.1 meters), with its harmonic center at 7,100 kc. It contains 18 commercial channels, viewed with envy and cupidity by a crass and vulgar commercial world. It is our chief international night band, and is open only to amateur telegraphy. Considering that we have nearly adequate privileges for domestic communication in the 3500-kc. band and are handicapped chiefly in our international bands, the League has proposed to the amateur societies of the world that the 7000-7300-kc. band be used in intra-continent work only for distances in excess of 1500 miles and that an informal and unofficial sub-division of the band be made for international working, whereunder amateurs of the United States would confine their transmissions to the portion from 7,000 to 7,150 kc., the remainder being partitioned amongst other groups of nations. This proposal is still pending.

14,000-kc. band. This band, once our joy and pride, extending from 14,000 to 16,000 kc. but never extensively occupied and held by amateurs, now reads 14,000 to 14,400 kc. (21.43 to 20.83 meters). Containing 13 commercial channels, it is our narrowest band in effective width, and as such dictates the center of the harmonically related portions of all of the bands, its center of course being at 14,200 kc. This is our daylight DX band, also used for super-DX at night. It is open only to telegraphy. In the same fashion as suggested for the 7,000 kc. band, the League has proposed the informal sub-division of this band amongst the amateur societies of the world, under which plan North American amateurs would confine their emissions to the portion 14,000-14,200 kc. This too is still pending.

28,000-kc. band. This is a new band extending from 28,000 to 30,000 kc. (10.71 to 10 meters) Although 2,000 kilocycles wide this band contains but 33 commercial channels and is therefore only of half the effective size of our "80-meter" band and just slightly larger than our "40-meter" and "20-meter" bands combined. The "harmonic center" is at 28,400 kc. The highest frequency regarded as being of commercial value is about 23,000 kc. and the value of this band is therefore questionable. Early experimenting has been fruitful, however, even over moderate distances, so that there is excellent reason for hoping that we shall be able to make this band of practical value to us before long. The international assignment is to "amateur and experimental," so that we may expect experiment stations of all descriptions to roam this band with us.

56,000-kc. band. This is what is left of the old "5-meter" band, now extending from 56,000 to 60,000 kc. (5.36 to 5 meters) and with its harmonic center at 56,800 kc. This also is "amateur and experimental" and perhaps a better term for it would be amateur experimental, as it has not yet been developed for practical communication. Much work has been done on it, by Kruse, Phelps, Douglass, Jones and others, and occasionally good signals have been heard at decent distances but with no reliability. This band and the 28,000 kc band are heaven for the experimenter, to whom we must look for methods which will eventually make them useful. 34 channels. The entire band is open for telephony work as well as telegraphy, and probably will be made available for amateur television and picture-transmission work.

As we conclude this informal analysis of our 1929 bands it seems all the more demonstrated to us that any proper appreciation of what we have and what we are doing next year must be in terms of frequency.

—*K.B.W.*

Errata

The following corrections should be made in the Bourne article on Acoustic Wave Filters in August *QST*:

p. 25, second paragraph, first sentence, should read ". . . . and attenuates currents of all other frequencies."

p. 26, next to last paragraph, last sentence, should read ". . . . we have attenuation from 0 up to f_1 and from f_2 on up, ..."

p. 27, third paragraph, for "diameter" read "distance."

Opportunity

By Hiram Percy Maxim, President, American Radio Relay League

When I was a very small boy my father and I used to ponder at length over the problem: Is it the salt fish that makes the ocean salt, or is it the ocean that makes the salt fish salt?

There is a somewhat similar problem to-day but there is no joker in it. Is Amateur Radio what we amateurs have made it, or are we amateurs what Amateur Radio has made us?

Amateur Radio is one of the amazing products of this century. Where before has an amateur group been depended upon in great public emergencies? Where before has an amateur group been depended upon for communications by every kind of an exploring expedition that starts out? Where before has an amateur group been depended upon by a great railroad system for its communications in time of emergency? Where before has an amateur group been depended upon to carry a message from the President of the United States to an explorer in the polar regions? And where before has an amateur group led the way in an important field of scientific research?

The answer is: Nowhere. And hence the question: Is there something about Amateur Radio that carries us amateurs along with it and makes us what we are, or is it we amateurs who have made Amateur Radio the wonderful thing it has become?

I believe it is we amateurs. We built up a splendid organization, which gave us the tremendous advantage of being able to work as an efficiently coordinated whole, instead of a disorderly mob. And this brought us OPPORTUNITIES, which we never otherwise would have had.

And all the OPPORTUNITIES have not passed. Radio telegraphy brought broadcasting. The latter brought the talking moving picture. And then meanwhile amateur moving pictures came along. They have brought that latest marvel, full natural colored amateur motion pictures. Commercial full natural colored motion pictures will quickly come from these, and full natural colored talking moving pictures will follow it. And then will come radio television in full natural colors.

Amateurs are to have golden OPPORTUNITIES in all of them. And it leads one to wonder which of us, obscure to-day, are to shine with the lustre of a Lindbergh tomorrow.

Let's keep everlastingly at it, fellows.

Pacific Division Convention

Oakland, California, October 11-12-13

YES fellows, the 9th annual convention of the Pacific Division is to be held at the Key Route Inn, 22nd & Broadway, Oakland, on the above dates and *some* program has been prepared. No dry technical talks, but of course there will be discussions. The big *motto* is a good time for every one with trips to Idora Park, where free rides on all concessions will be had; swimming, roller skating, etc., on one of the days—the next day at Lakeside Park where free picnic lunch will be served and where a number of stunts will take place. A special trip will be made to San Francisco where the gang there will entertain the delegates.

The committee in charge is working hard to outclass all previous conventions but we will need your attendance to do this. Come one, come all—every one will be welcome.

Write S. G. Culver, the convention secretary, Box 549, Oakland, Calif., that you will be present.

Strays

Perhaps the simplest way to get a good musical note would be to paint the set with phonograph records dissolved in alcohol.

—*6BWS*

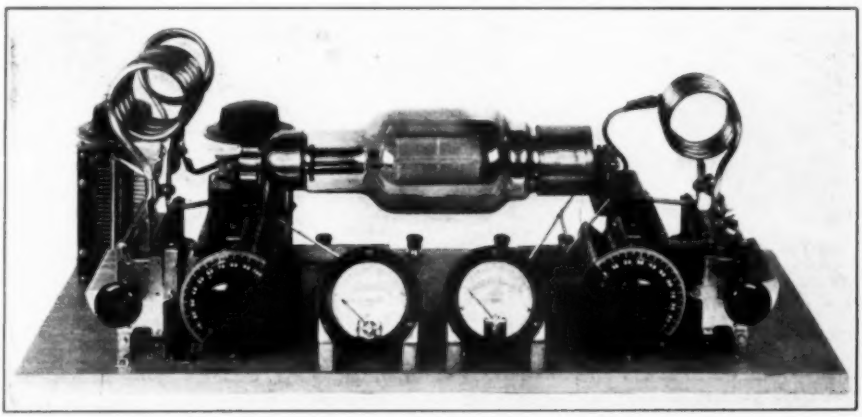
Adapting Medium and High-Powered Self-Excited Transmitters for 1929 Service

Some Design, Constructional and Tuning Considerations Involved

By Ross A. Hull*

As a sequel to "Overhauling the Transmitter for 1929," which appeared in the August *QST*, this article treats the particular modifications which are desirable in transmitters of medium or high power. It is assumed that the reader will have made a detailed study of the preceding article. If this is not so, a complete understanding of the present outline will be impossible.—Editor.

NO one will deny the existence of a belief, among radio amateurs, that a transmitter assembled neatly behind a shining panel and equipped with a fine array of meters and control knobs never works quite so well as did the same apparatus in its early life, spread in wild confusion across a table top. Nor can it be denied that there exists an equally fallacious belief to the effect that the circuits and values of a successful low-powered transmitter will not provide an equivalent performance when high power is used. We had built low-powered transmitters which provided a "1929 performance" but there was too much of the radio amateur in our make-up to allow us to approach the application of the same ideas to high-powered work without considerable concern. There was, it seems, that inborn fear that the performance of our transmitters would drop sadly as the power was raised. For a week or more, the Laboratory was filled with odors of burning bakelite, hard rubber and wood, and at times whiffs of smoke drifted lazily across the tables—but in the end our pulse had returned to normal, for we had found that even 250-watt self-excited transmitters can be made to behave in a 1929 manner with just the same treatment we had given the low-powered set.



ONE TYPICAL HIGH-POWERED SELF-EXCITED TRANSMITTER WITH A "1929 TYPE" PERFORMANCE

Heavily built with conductors, resistors, condensers, transformers and chokes of ample proportions, provided with High-C grid and plate tanks, and tuned with extreme care, this transmitter behaved admirably both in the Laboratory and when later operated under average conditions. In two evenings, when five countries were "worked", the reports—whether we believed them or not—were all "d.c. crystal-control".

The treatment, as we explained last month, consisted of installing High-C tuning circuits, making all conductors, condensers, resistors, transformers and chokes of ample proportions, and tuning with extreme care to keep the grid excitation at the most desirable value, the antenna coupling at the lowest practical point and the antenna detuned on the particular side of resonance which provided the cleanest signal.

The only serious problem, of course, was that involved in the use of the High-C circuits which we had found so effective

*Associate Technical Editor, *QST*. In charge A.R.R.L. Technical Development Program.

in the low-powered transmitters. Calculation showed us that we could expect tank currents of the order of 18 amperes if we employed the capacity-inductance ratios of the low-powered sets, and much experimental work preceded the construction of tank circuits in which the losses were low enough to be justified without question by the improvement in performance.

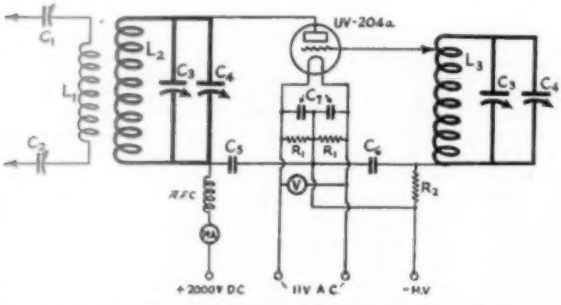


FIG. 1. THE CIRCUIT OF THE TRANSMITTER ILLUSTRATED

C1, C2—440-μμfd. variable antenna or feeder tuning condensers.
C3—440-μμfd. variable condensers connected across the tuning condensers used to provide adjustable "lumped" capacity for the High-C circuits.
C4—330- or 250-μμfd. tuning condensers.
C5—100-μμfd. fixed by-pass condenser (5,000-volt rating).
C6—100-μμfd. fixed grid condenser (5,000-volt rating).
C7—2000-μμfd. fixed filament by-pass condensers (2,500 volt rating).
R1—100-ohm center tap resistors. A center-tapped filament transformer can be used instead.
R2—Heavy duty 10,000-ohm grid leak. Leaks rated at 75 watts or less usually will heat appreciably and cause frequency creeping.
R.F.C.—160 turns of 26 gauge D.C.C. wire on a ¾" diameter form.

This circuit was used in the transmitter under discussion in preference to the Hartley or Colpitts merely because of its particular adaptability to a tube having its grid terminal at one end and its plate at the other. Any one of the many satisfactory keying methods which have been described in *QST* can be used.

A TYPICAL TRANSMITTER

The final transmitter, built at the completion of the experimental work to provide a typical example of the manner in which the high-powered transmitter should be remodeled for 1929, is that illustrated in these pages. We will first describe it in detail and then proceed to a discussion of the manner in which the same principles could be applied to transmitters of other types.

A UV-204-A tube was selected for use in the "sample" transmitter since it is the largest tube readily available to the amateur and so is the tube most suited for use in a 1929-type high-powered outfit. A great many amateurs attempt to build a successful high-powered transmitter by using a UX-852 or similar tube running at four or five times its rated power but there is not the slightest question that this procedure cannot be followed in any self-excited transmitter if a 1929-type performance is to be expected.

The circuit used is the tuned-grid tuned-plate, selected on account of its mechanical suitability for use with a long tube having its grid terminal at one end and its plate at the other. Other circuits could have been used but with this particular tube they would not have permitted the same simplicity of layout or directness of wiring.

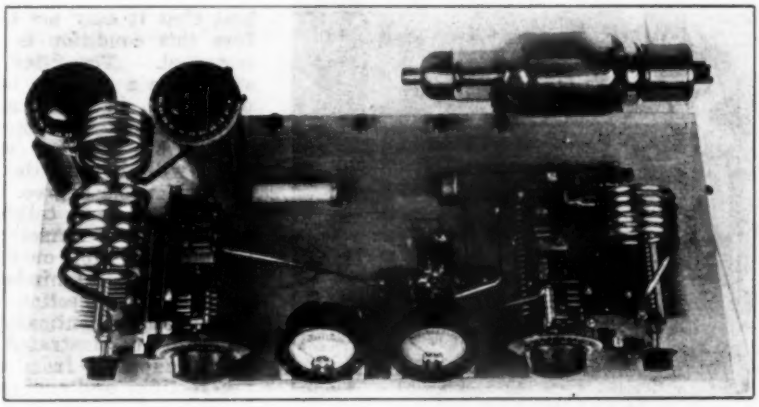
TANK CONDENSERS

The variable condensers throughout are of standard types. Many types of pie-plate, copper disk and copper tube condensers for the tank circuits were built, and still more designed, but considerations of compactness and simplicity invariably brought us back to the use of the standard types connected in parallel to give the necessary capacity. We admit, however, that there is a splendid field of endeavor in the evolution of cheap and effective "home-brew" fixed or adjustable tank condensers to be added in parallel with existing tuning condensers. The most important requirements will be the use of heavy copper sheet for the plates, and pyrex glass, high quality hard rubber or well dried wood for the insulation; the use of heavily-soldered connections to all plates, and the provision of some means of halving and quartering the capacity so that it may still be used on the highest frequency bands. In both the grid and plate circuits of this transmitter, a Cardwell Type 199 condenser is run in parallel with a Type 147B, the former used for tuning adjustment, having a maximum capacity of 330 μμfds., and the latter used as an adjustable lumped capacity, contributing 440 μμfds. The two feeder or antenna condensers are of the Type 147B. "Double-spaced" condensers are all that are necessary for the plate tank of a tube supplied with 2000 volts when a High-C circuit is used. Where plate voltages of the order of 500-1000 are used the spacing used in good receiver-type condensers is satisfactory. In the grid circuit the voltages are still lower but it was still found worth-while to use "double-spacing" where the plate voltage is of the order of 2000 volts.

INDUCTANCES OF UNUSUAL PROPORTIONS

The grid and antenna inductances are wound with ¼" copper tubing, this being of suitable size for the currents

flowing in the circuits in which they are connected. The plate coils, however, are of much heavier construction. Our first plate tank had an inductance of the same ¼" copper tubing as that for the grid and antenna coils, the temporary connections to the condensers being made with clips heavily soldered to cables of about the same diameter as the tubing.



THE "250-WATT" TRANSMITTER AS SEEN FROM ABOVE

At the right is the grid unit comprising the tank circuit with its two variable condensers in parallel, and the heavy duty grid leak immediately behind them. Of the four fixed condensers arranged in a group, that on the right is the grid condenser. On the left of the group is the plate circuit by-pass condenser, the remaining two serving as the filament by-pass. On the left side of the transmitter is the High-C plate tank, with its unusually heavy inductance, and the antenna tuning unit. To the right of this plate unit the radio frequency choke can be seen.

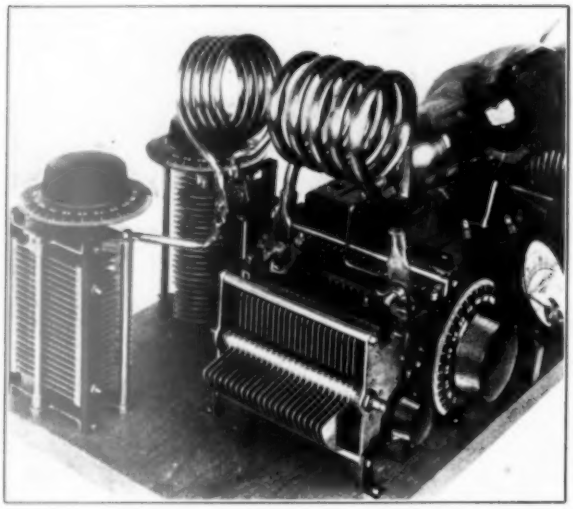
After a run of a few minutes the conductors heated to the point where solder is liquid and the whole thing fell apart. The plate coils eventually decided upon as the mean of efficiency and clumsiness are of ⅜" tubing, the ends, as in the case of the other coils being sweated into copper lugs of the type used in power switchboard wiring. The plate and grid coils are attached with machine screws and wing nuts to ½" wide, copper strips which serve also as the connectors between the two variable condensers. The exact arrangement of this mounting can be seen in the photographs. The antenna coils are mounted in a somewhat similar fashion on brackets projecting from the two series condensers. The important points to observe are that the plate and grid coils are mounted directly on the condensers, so avoiding any long leads; that the connections between the coils and condensers are of heavy construction with large contact areas, and that the mountings are sufficiently substantial to avoid the possibility of vibration of the coils unless they are actually struck. It might be admitted that even the plate and grid coils of the present transmitter could be improved upon if the transmitter were to be operated for long periods at higher power than the rating of the tube, for both of them, under such conditions, heat appreciably. Experiment with High-C circuits covering the widest practical range of values and dimensions has led us to recommend that plate and grid tanks similar to those of the transmitter under discussion be used in cases where the input power is between 100 and 400 watts. For inputs greater than these it is suggested that ½" outside diameter tubing or, preferably, ¾" wide, heavy copper strip, be used for the plate coil and ⅜" tubing or ½" strip for the grid. In all cases the leads to the tank condensers should be of similar conductor to that used in the inductance and some heavy clamping device should be used for the connections. *Clips simply will not serve the purpose.*

Further comment on the constructional details of the transmitter are hardly necessary for the minor points can well be gleaned from a study of the circuit diagrar and the photographs. It can be said, however, that it is not suggested for one moment that the transmitter represents the acme of mechanical and electrical perfection. It is presented merely as an example of the simple modifications necessary to equip the amateur transmitter with High-C tanks, mechanically rigid construction and, as the outcome, the ability to produce signals of 1929 standard when tuned correctly.

REBUILDING EXISTING TRANSMITTERS

In quite the majority of present-day amateur transmitters, complete re-construction would not be necessary in order to modify them in accordance with the ideas set out

herein. In a Hartley transmitter employing a UX-582, for instance, the only important changes might well be in the mounting of the tube so that its grid and plate leads are convenient to the plate tank, the addition of a second variable condenser in parallel with the existing plate condenser, and the provision of a new set of plate coils with suitable heavy mounting and connections on the condensers.



A "CLOSE-UP" OF THE PLATE TANK AND ANTENNA TUNING UNIT

In the immediate foreground is the 440-μμfd. variable condenser providing "lumped" capacity, adjustable for the various frequency bands. Behind it, and connected in parallel with it, is the main tuning condenser. Heavy copper strip is used for all connections in the tank, the inductances being attached to the tank condensers with ¼" machine screws and wing nuts. Coupling between the plate and antenna coils is varied by swinging the latter on its mounting.

In a Colpitts transmitter the same process would apply, the particularly important point in this case being to remember that the "bridge condensers" and the condenser joining the two coils in the "split Colpitts" all must be considered as tank condensers and so must not only be proportioned to give the required total capacity across the coil but should be of a high grade, air dielectric type. Small mica dielectric condensers could not be used effectively in these roles.

Of course, in all probability, the alterations also would involve a general clean-up of wiring, a stiffening of the antenna coil and its mounting, and some re-rigging of the antenna to avoid appreciable vibration or swinging. Then, it may mean installation of a separate filament transformer to avoid filament-voltage fluctuations during keying or the use of a separate power outlet for the filament supply if a filament transformer is being used and fluctuations still occur.

Aside from these matters, the attainment of a 1929 signal with the self-excited circuit will most certainly mean the dumping of a.c. or "self-rectified" plate supply and the installation of some form of rectifier or a generator. At the moment, sad to relate, the only truly practical rectifier for the UX-852 or UV-204-A is the mercury arc, but we are fortunate in being able to hint that it may not be long before this condition is effectively remedied. The filter system is still to be a problem but the improvement in the plate-voltage-vs.-frequency characteristic afforded by the use of High-C tanks will simplify the matter to a considerable degree. We dislike the idea of talking results and so leaving ourselves open to misunderstanding on the part of the more literal-minded readers, but in this connection we cannot refrain from mentioning that the transmitter illustrated on these pages, supplied from a mercury arc rectifier and equipped with a 2 μfd. condenser as its only filter, can produce a piercing "d.c." note on which modulation can be detected only by the hypercritical observer.

ADJUSTING FOR A 1929 PERFORMANCE

The tuning process for the high-powered transmitter is similar to that described last month for the low-powered set, the chief difference being in the observance of extreme care in avoiding contact with any

THE TYPE OF PLATE INDUCTANCE SUGGESTED FOR USE WITH INPUT POWERS GREATER THAN 400 WATTS

Built of ⅛" thick copper strip ¾" wide, inductances of this type proved satisfactory in the High-C plate tank even at the highest possible input to the tube. Careful comparison with the ⅜" copper tube inductances, however, revealed no improvement in performance that would justify their use with input powers less than 400 watts under normal conditions of efficiency. Rather, the scarcity and expense of the strip, and the difficulties entailed in winding it, made the tubing much to be preferred.

metal part of the set. The operator can be killed suddenly and very effectively by coming into contact with the transmitter in the right (or wrong, if you wish) manner.

In the tuned-grid tuned-plate circuit it is well first to set the plate condensers at

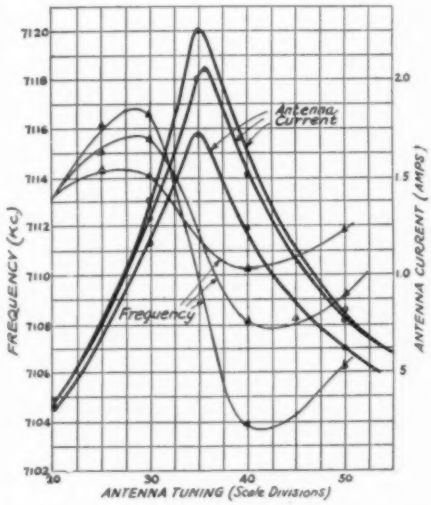
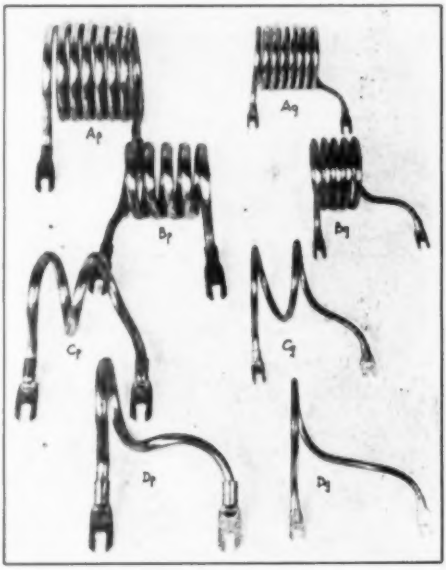


FIG. 2. ANTENNA-TUNING VS. FREQUENCY CURVES FOR THREE VALUES OF ANTENNA COUPLING

In addition to showing a performance similar to that of the low-powered transmitter described last month, these curves provide further indication of the splendid improvement in stability afforded by loose antenna coupling.

some estimated value with the grid tank condensers at zero. Then, with the antenna coil removed, the plate voltage (reduced to about 75% of the rating of the tube) can be applied, and the grid tank capacity increased slowly until the plate current dips and then rises to a value about 10% higher than the minimum. At this point the frequency should be checked, and if it is not within the band the process should be repeated until it is. At this stage the antenna coil can be coupled loosely and the antenna or feeder circuit tuned until maximum current is indicated. If the plate current at this point is still below the rating of the tube, when the voltage has been increased to normal, the grid capacity can be increased until it has climbed to the required value, at which time the antenna tuning should be readjusted. Each change in the constants of the grid circuit will mean changes in frequency and so continual checking with the frequency meter will be necessary. The antenna coupling can now be increased until maximum antenna current is obtained and immediately it should be reduced until the antenna current is about 85% of the maximum value. It is at this stage that it is so essential to check the signal with a monitor or "Growler" in order to observe on which side of resonance the antenna should be detuned in order to obtain the cleanest signal and in order to permit that final polishing of all adjustments which is to mean the difference between a good 1928 and a 1929 performance. The monitor will be indispensable also in deciding upon the connections to the antenna coil. With symmetrical current-feed antenna systems the difference in note with the leads to the antenna coil connected one way or the other usually will not be marked but in the as-



GRID AND PLATE INDUCTANCES FOR FOUR FREQUENCY BANDS

For the 3500 kc. band Ap and Ag are the coils used, Ap being 3½" inside diameter and Ag 2⅜". Bp and Bg serve for the 7000 kc. band, Cp and Cg for 14000 kc., and Dp, Dg for 28000 kc. With the exception of coil Ap the coils are all 2⅜" inside diameter. The plate coils are of ⅜" outside diameter copper tubing, and the grid coils of ¼" tubing. All of them were wound by hand on pieces of iron pipe. This procedure is possible, however, only when the tubing is of the "soft drawn" grade.

symmetrical antenna feed systems such as the "Zeppelin," the vertical current-feed antenna or the "antenna-counterpoise" arrangement, many adjustments can be obtained with which one particular connection must be observed. In the transmitter under discussion with the particular antenna used the shrill "d.c." note gives place to a heavily modulated signal just as soon as the feeder connections are reversed.

The more we tune transmitters the more convinced do we become that the amateur transmitter can be tuned about as success-

fully by watching the meters alone as an automobile can be driven in heavy traffic by exclusive observance of the ammeter and the oil gauge. We can see no more justification in the amateur operating his transmitter without being able to hear what his signal is doing than in the motorist driving his car without the ability to see where he is going. In fact we can forsee the possibility of the introduction of another crime in amateur radio punishable by Wouff Hong—that of operating a transmitter without monitoring it throughout every transmission. Why, broadcasting stations are put off the air for failing to do that very thing!

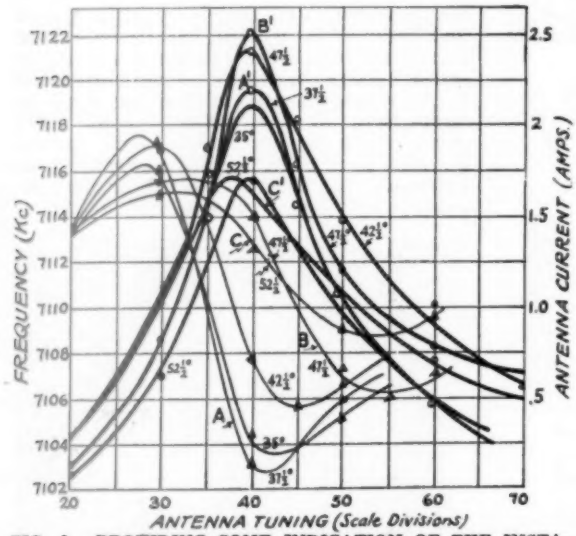


FIG. 2. PROVIDING SOME INDICATION OF THE INSTABILITY ACCOMPANYING LOW VALUES OF GRID EXCITATION

Curves A, A1 were taken with the grid condenser set at the value which gave minimum plate current. Serious frequency instability was noted and the curves could not be duplicated by rotating the antenna condenser in the opposite direction. Satisfactory stability could only be obtained by the use of extremely loose coupling. Curves B, B1 were taken with that value of grid excitation which gave the rated plate current for the tube under normal conditions. Much greater frequency stability is indicated and the frequency curve B could be checked and rechecked at any point. With still greater grid excitation curves C, C1 obtained. The rather flat frequency curve C, however, was accompanied with a considerable loss of output and serious heating of the tube. The adjustment was not one which could be used in practice. With this circuit the adjustment of grid "tuning" and antenna coupling are closely related. Low or high values of grid excitation require extremely loose antenna coupling to give satisfactory frequency stability whereas, with grid excitation of a particular order, the normal antenna coupling can be used and high efficiencies obtained. A study of the signal in the monitor can be depended upon to reveal this desirable value of grid excitation.

Strays

Save Postage!

Since July 1 private mailing cards, if they conform to standard government post-card size, 5½" wide x 3¼" high, may go thru the mails, in the United States and its possessions only, with only a 1-cent stamp affixed. When making up your QSL cards have them of the above dimensions (unless you use the government 1-cent card) and you will save 1c on each card. Private mailing cards of other sizes still take 2c each. Add this latest information to the rates already given on page 26 of the July, 1928, issue of *QST* and save yourself money.

8AA, on his new card, has replaced all the conventional dotted lines with the statement "Believe it or not! Your 'Pure d.c. Crystal-control signals' pounded in here R9 on ..... 19..." That's one more stunt that won't be novel any more.

Undesirous of climbing the high roof of a rickety barn to unhitch his old antenna, and anxious to make room for his new one, 1BZJ hit upon the idea of shooting it down with a "22" rifle. A single shot, it is said, sufficed.

YL—"And what's the furthest place you've ever reached with your radio?"

Ham—(Wondering whether she meant transmitting or receiving.) "Elucidate".

YL—(She must have been a bit dumb.) "Never heard of it."

1BHB, 1ARA

6BWS has built a new 5 meter transmitter. The component parts comprise a filament meter, plate meter, grid meter, antenna meter and wavemeter. [We used that this month because we are to talk frequencies from now on.—Editor.]

Special Despatch to the Toronto *Globe*. (Extra special we'll say) Quebec,—

"Hidden in a shabby street here has been found what is described as the most powerful radio set in America, the machine being in the possession of a 21 year-old Russian. With this set Arsene Nelna is said to have been in communication with European Capitols for the last two years. ——— The powerful radio is called a "Kolster Decremeter", ——— and it is the last word in telegraphy and wireless telephony. With this machine, it is stated, Nelna has been talking to Paris, Petrograd, Berlin and London every day for several years. What these messages are may lead to startling discoveries."

Why, yes. The "Kolster Decremeter" may yet be the cause of another World War.

The UX-860

A Screen-Grid Power Tube

By Harold P. Westman, Technical Editor

THE long line of radio tubes already available to the amateur and experimenter has recently had a new youngster of rather husky proportions ushered into its midst under the alphabetical-numerical cognomen of the UX-860. It being a "power" tube, there is no "CX" or Cunningham designation involved.

The UX-860 is a screen version of the 852. In cases where the 3.3 μμfd. grid-to-plate capacity of the 852 causes trouble, the 860 may be substituted and its reduction of this capacity to a value of .05 μμfd. should be very helpful. It is designed primarily for use as a radio frequency amplifier at frequencies greater than 3,000 kcs. The screen-grid does away with the necessity of neutralization although it by no means does away with the need for proper shielding of the external circuits.

While it may be used as an oscillator, it has no particular advantage over the 852 as such nor is it generally suitable for use as a modulator or audio frequency amplifier due to its high plate resistance.

This tube very much resembles the 852 in appearance. It is of the T type in which the plate and grid are supported on separate stems with their leads brought out through separate seals which insure low capacity and high insulation. The filament is supported on a third stem and its leads together with the lead from the screen grid are brought out through another seal. As in the 852, the filament leads terminate in a UX base, the screen-grid being connected to the grid terminal of this base.

A thoriated tungsten filament in the shape of a double helix is supported from a center rod and requires no springs. The plate is cylindrical with six fins or wings to dissipate heat. The screen is of close mesh and is interposed between the control grid and plate. It is as high as the tube and is supported by collars clamped to the filament and grid stems.

The filament should be operated at its rated voltage. Loss of emission may be occasioned by either overloading or underloading the filament. Loss of emission due to reduced filament voltage is due to too low a rate of diffusion of the active material to the surface of the filament. This is materially hastened by the application of abnormal plate voltage and high plate current.

As with the other tubes employing thoriated tungsten filaments, severe overload may cause a decrease in emission. Providing a large amount of gas has not been liberated, the emission may be restored by disconnecting the plate and screen-grid voltages and operating the filament at normal voltage for ten minutes or more. The time required for reactivation may be decreased by raising the filament voltage to 12 volts.

The maximum plate dissipation either as an amplifier or oscillator should never exceed 100 watts. This corresponds to a cherry red color of the plate. Looking at

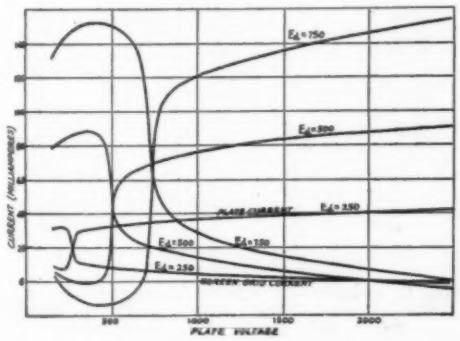


FIG. 1. SHOWING THE VARIATION OF BOTH SCREEN-GRID AND PLATE CURRENT WITH CHANGES IN PLATE VOLTAGE, CONTROL GRID VOLTAGE BEING ZERO AND FILAMENT VOLTAGE, 10.

the plate with the filament lighted is apt to be misleading because of the reflection of the light from the filament. It is best to turn the power supply to the tube off and note the plate color.

The screen voltage may be obtained from a separate source or from the plate supply system. The use of a separate source is not only expensive but does not offer as much safety as does the second method. If the plate voltage is removed and the screen voltage maintained, the screen current will increase considerably and overload that element, destroying it perhaps. On the other hand, if the screen voltage is obtained from the plate supply system, any changes in plate voltage will also result in a change in screen voltage and the ratio of the two will remain about the same, thus eliminating this danger.

If a resistance of approximately 100,000 ohms be placed between the positive terminal of the plate supply and the screen, the voltage on the screen will be of a satisfactory value. When using this method of

supply, the filament circuit should not be opened with the plate voltage on or the full plate voltage will be applied to the screen needlessly stressing the seal, etcetera. In all cases, the impedance between the screen and filament must be kept low by means of by-pass condensers. At no time should the screen dissipation exceed 10 watts which as in the case of the plate is indicated by a cherry red coloring.

Under normal operation, a bias of approximately 200 volts should be applied to the control grid. When a leak is substituted for battery bias, its value should be about

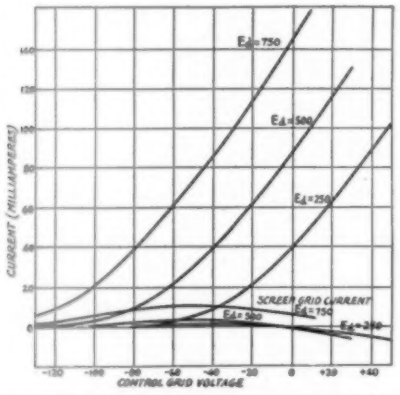


FIG. 2. EFFECT OF CONTROL GRID VOLTAGE UPON SCREEN-GRID AND PLATE CURRENT WITH 2000 VOLTS ON THE PLATE.

10,000 ohms. The value of bias is not critical and variations to suit particular circuit arrangements may be made. Both grid and plate leads are in the form of two conductors which should be twisted together. If only one of these conductors is used, excessive heating at the seal may result.

Some characteristics of the tube are given herewith:

Filament voltage	10.
Filament current	3.25 amperes.

The following values are obtained with normal plate voltage (2000 volts) zero grid bias and normal screen voltage (500 volts);

Plate current	70 milliamperes.
Plate resistance	150,000 ohms.
Mutual conductance	1.35 milliamperes/volt.
Amplification factor	200.

Approximate direct interelectrode capacities (I. R. E. definitions).

Plate-to-grid (Filament and screen grounded)	.05 μμfds.
Grid to filament and screen	8.5 "
Plate to filament and screen	9.0 "

Maximum operating plate voltages

Modulated plate voltage d.c.	2,000. volts.
Non-modulated plate voltage d.c.	3,000 volts.
A.c. plate voltage (r.m.s.)	3,000. volts.
Maximum plate current d.c.	100. mils.
Maximum plate dissipation	100. watts.
Maximum screen dissipation	10. watts.
Nominal screen voltage	500. volts.

The filament voltage current characteristics are the same as for the 852 and are not given here. This curve may be found on page 21 of the May, 1927 issue.

This tube should be of interest to those operating crystal controlled transmitters or other types of oscillator-amplifier circuits at the higher frequencies where feedback is so damaging.

As with all other power transmitting tubes excepting the 852, the 860 may only be obtained directly from the Engineering Products Division, Radio Corporation of America, 233 Broadway, New York City, New York. To save you the trouble of telling us that the 210 and 250 are obtainable through dealers, we should like to point out that these types are now considered as being primarily amplifier tubes for broadcast receivers and not transmitting tubes exclusively.

Correction

An error was made in figure 1 in the article "Some More About the Family" by A. B. Chamberlain which appeared on page 29 of the July issue. The ordinates should be labelled "TU Loss" rather than "TU", thus indicating a loss of high frequency audio energy due to transmission over a bare circuit. This is compensated for by the equalizer which has opposite characteristics.

9XL Transmissions

(Continued from Page 8)

Friday Evening Schedules
Central Standard Time

Time (PM)	Schedule A f	λ	Schedule B f	λ
8:30	3.5	(85.7)	7.0	(42.8)
8:42	3.75	(80.0)	7.2	(41.6)
8:54	4.0	(75.0)	7.4	(40.5)
9:06	8.5	(35.3)	7.6	(39.5)
9:18	9.0	(33.3)	7.8	(38.4)
9:30	9.5	(31.6)	8.0	(37.5)

Sunday Afternoon Schedules
Central Standard Time

Time (PM)	Schedule C f	λ
3:00	14.0	(21.4)
3:12	14.2	(21.1)
3:24	14.4	(20.8)
3:36	15.0	(20.0)
3:48	16.0	(18.7)

September 14–Schedule "A" October 12–Schedule "A"
16– "C" 14– "C"
28– "B" 26– "B"

DIVISION OF TIME

3 minutes—QST QST QST nu9XL.
3 minutes—5 second dashes broken every half minute to give station call letters.
1 minute—announcement of frequency in megacycles per second (8.75 megacycles is sent as "8r75 MC.")

If you use these transmissions please send a note to the Experimenters' Section, A.R.R.L., 1711 Park St., Hartford, Conn.

—*H. P. W.*

The Zepp

Facts and Figures for the Design of the Hertz Antenna with Two-Wire Voltage Feed

James J. Lamb*

THE general principle of the two-wire feeder is as old as the theory of electric waves on wires. The Hertz antenna is as old as the theory of electric oscillations. Therefore this article is founded on ancient history, and anyone interested in digging deeper into the theory and mathematics of the thing may do so by looking up the chapter on electric waves on wires in Fleming[1], (edition of 1910), or in Pierce's "Electric Oscillations And Electric Waves." The latter, by the way, covers the theory of feeders beautifully.

There are two types of antenna feed in general use among amateurs today, one being what is called "voltage" and the other "current". The names have not as much to do with the feeders themselves, as with the point at which they are connected to the antenna. The voltage feed system is coupled in some manner to the antenna at a voltage antinode (usually at one end) while the current feed type is coupled in some manner to the antenna at a current antinode, usually the center or an odd quarter wave from one end. The feeder systems are themselves of two general types, the first complex in design and suitable for one fixed frequency, the second wonderfully adaptable to amateur use.

The first system is that in which the output impedance matches the impedance of the feeder system thereby preventing wave reflection and standing waves on the feeder wires.[2] The second, is that in which the output terminals are open circuited, there being full reflection and consequently standing waves on the wires.[3] The second, when used as a voltage feeder, is the familiar Zeppelin, and the one in which we are interested.

The conventional case of two parallel wires with their output ends open circuited and with a non-reflective source of high-frequency sinusoidal E.M.F. at the input end is shown in Figure 1. In the case of the two parallel wires as used in amateur feed systems (the attenuation being negligible) we shall have maximum amplitude of current at G at a given frequency, (wavelength) when the length L of each of the wires is *equivalent to an odd multiple of a quarter wavelength*. The current at the ends of the wires will, of course, be zero, and the voltage amplitude a maximum. There will be a phase difference of 90 degrees between the voltage and current at any point on either wire, due to full reflection, and the current at a given point on either wire will be 180 degrees out of phase with current at a similar point on the other wire an equal distance from the source. The field about either wire will therefore cancel that of the other, and little or no electro-magnetic radiation will result.

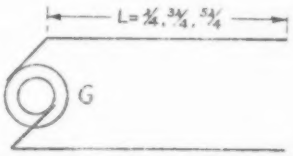


FIG. 1. TWO PARALLEL WIRES WITH THEIR OUTPUT ENDS OPEN CIRCUITED AND INPUT SUPPLIED WITH A HIGH FREQUENCY SINUSOIDAL E.M.F. FROM A NON-REFLECTING SOURCE G. EACH WIRE IS AN ODD MULTIPLE OF ¼ WAVELENGTH LONG

If a wire equal in length to *an even multiple* of a quarter wavelength is now added to one side, as shown in Figure 2, the relation of forward to reflected waves remains the same as in the case of Figure 1, but the extension is a linear oscillator in free space, radiates electro-magnetic waves, and becomes an antenna. This is one way of explaining the theory of the two-wire volt-

1SZ-1CEI. Technical Information Service and Experimenters' Section, A.R.R.L.

1. *Principles of Electric Wave Telegraphy and Telephony*, by J. A. Fleming.

2. *Matching the Transmission Line to the Antenna*, by Walter Van B. Roberts, *QST*, Jan. 1928. The voltage and current are practically in phase, there being just sufficient potential difference between the input and output terminals to offset the drop in the line. A neon tube run along the length of such a feeder system should glow with practically constant brilliancy at all points indicating almost constant voltage distribution.

3. When there is a full reflection from the output terminals, the voltage and current are in phase quadrature, or 90 degrees out of phase with each other. Standing waves on the wires accompany reflection and are indicated by points of maximum and minimum voltage and current. The distance between two points of maximum current or voltage is ½ wavelength and the distance between a point of maximum current and one of maximum voltage is ¼ wavelength. A neon lamp run along the wire will glow with the greatest brilliancy at a voltage antinode and will show no glow at a voltage node.

age feed or Zeppelin antenna. Now that we have the theory, we can tackle the actual design.

There are three essential requirements in the dimensions of a successful "Zepp", and these are:

(1) The feeder system must be such that each wire is equivalent in length to an odd multiple of one quarter of the wavelength being used. In other words, the feeder (both wires as a unit) must be tuned to the fundamental or an odd multiple of the fundamental of the wavelength being used.

(2) The antenna must have a length equivalent to an even multiple of one quarter wavelength.

(3) The feeder system must be electrically symmetrical.

Since the antenna or radiator is first erected and the feeder system suspended from it, we will now take up its design and construction.

THE LENGTH OF THE ANTENNA

The length of the antenna or radiator for a given frequency will not be the same for all conditions. If it runs close to the ground, immediately over a tin roof, near a grounded gutter-pipe or lightning rod cable, its natural period (in terms of frequency) will be lower than that of the same antenna in the utopian state known as "free space". The antenna will not have to be very far "above ground", however, to become apparently quite free from the loading effect of capacity to ground and the length may therefore be calculated as for a radiator with zero inductive and capacitative loading in free space and later shortened as may be required. The lowest frequency at which an unloaded Hertz antenna may be operated is its fundamental. When so operated it is a "half wave", or its length is equivalent to one half the wavelength at which it is operated. Therefore, the shortest antenna length we may have is a half wave of the longest wavelength we are to use. The antenna may, of course, be operated at frequencies which are harmonics of the fundamental frequency, or wavelengths which are ½, ¼ or 1/6 of the fundamental wavelength. Let us suppose that we wish to design an antenna to operate on the four amateur bands of 3,500-, 7,000-, 14,000- and 28,000-kc. (80, 40, 20- and 10 meters). The shortest antenna which may be used is a ½-wave 80-meter radiator, although it could be made a ½-wave 160-meter radiator and operated as a 2/2-wave antenna on 80 meters. One meter is 3.28 feet, and the length of the ½-wave 80-meter antenna is therefore ½ x 3.28 x 80 or 131.2 feet. We make the antenna of this length to start with and later shorten it, if necessary, after giving it a check by the method to be described further on.

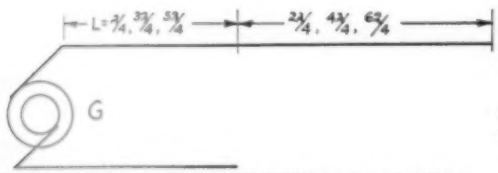


FIG. 2. WIRE OF LENGTH EQUAL TO AN EVEN MULTIPLE OF ¼ WAVELENGTH ADDED TO ONE SIDE OF THE SYSTEM

In actual practice G is the antenna inductance and associated tuning apparatus.

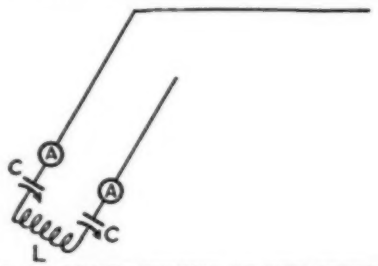


FIG. 3. SERIES TUNING OF THE FEEDER SYSTEM

Having our radiator now prepared for suspension between heaven and earth, we are ready for the feeders.

DESIGN OF THE FEEDER SYSTEM

As stated before, the feeder system as a whole must be tuned to the fundamental or an odd multiple of the fundamental for the wavelength being used. In other words, the feeder system must be ½-wave, 3/2-wave, 5/2-wave etc. The feeder system might be so constructed as to have each feeder wire exactly equivalent to an odd multiple of ¼-wave in length, allowance being made for the loading effect of the input inductance, but this would be a tedious process and would permit operation on one fixed frequency only. The amateur demands a system which is flexible in adjustment and which permits ready and rapid QSY from one band to another. The solution is, then, to have the system tunable, and moreover tunable in the station itself. This is provided in the two tuning arrangements shown in Figures 3 and 4. The series system is used when the natural wavelength of the feeder system including the antenna inductance is slightly above the fundamental or odd multiple of the fundamental of

the working wave. The parallel tuning arrangement is used when the natural wavelength of the feeder system including antenna inductance is above an even multiple of the working wave but less than an odd multiple. In other words, if the length of the feeder is such that the natural wave length of the feeder system is between ½ and 2/2 or between 3/2 and 4/2 wave etc., the series tuning arrangement is used. If this natural wavelength is between 2/2 and 3/2 or between 4/2 and 5/2 etc., the parallel arrangement is used. The series arrangement is used when it is possible to go down to the next odd ½ and the parallel when it is desirable to go up to the next odd ½. Figure 5 shows some convenient feeder lengths and the system of tuning most satisfactory for each of the amateur bands.

It is interesting to note that there are some particular lengths which are such that it is impossible to get down to the next odd ½ wave by series tuning and just as impossible to go up by parallel tuning. Care should be taken in putting up the feeders not to hit upon such a length. This situation results when the feeders are of the order of 25 feet in length and it is desired to work on 20 meters. The jump to ½ wave is too much for series tuning. To go to 3/2 wave puts more than ½ wave in the antenna tank circuit when the parallel arrangement is used, and very little energy transfer from the oscillator output to the feeder input is possible. Increasing the feeder length to 30 feet, however, permits parallel tuning on the 20-meter band while series tuning is used on the 40 meter band.

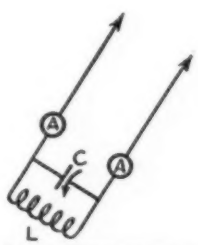


FIG. 4. PARALLEL TUNING OF THE FEEDER SYSTEM

The lengths specified in the table shown in Figure 5 need not be exactly followed, a variation of a few feet one way or the other being permissible, particularly on the longer feeders.

There is one salient requirement in the feeder construction. It must be *symmetrical*. Each wire must be exactly the same length as the other. This is particularly important when the system is to be operated on the higher frequencies where a foot is a considerable part of a wavelength, and an apparent slight degree of asymmetry would result in a comparatively great asymmetrical voltage and current distribution, causing a loss of a considerable amount of the non-radiating properties desired in the feeders.

APPROXIMATE LENGTH OF EACH WIRE, FEET	TUNING ARRANGEMENT FOR VARIOUS BANDS				
	1750 kc (160 m.)	3500 kc (80 m.)	7000 kc (40 m.)	14000 kc (20 m.)	28000 kc (10 m.)
120	SER.	PAR.	PAR.	PAR.	SER. OR PAR.
90	PAR.	SER.	SER.	PAR.	SER. OR PAR.
60	PAR.	SER.	PAR.	PAR.	SER. OR PAR.
40	(---)	PAR.	SER.	PAR.	PAR.
30	(---)	(---)	SER.	PAR.	SER. OR PAR.
15	(---)	(---)	PAR.	SER.	PAR.
8	(---)	(---)	(---)	PAR.	SER.

SER.–*Series Tuning* PAR.–*Parallel Tuning* (---)–*Not Recommended.*

FIG. 5. SOME SUGGESTED FEEDER LENGTHS AND RECOMMENDED TUNING METHOD FOR EACH OF THE AMATEUR BANDS

The distance by which the wires should be separated is not critical in value, although there is an optimum value. They must be close enough together to give effective cancellation of their respective fields and far enough apart so that minute vibration with respect to each other will not cause proportionate variation in the inter-wire electro-static capacity of sufficient magnitude to cause, in turn, appreciable variation in the feeder tuning and consequent wobbulation of frequency. A value of separation which seems to meet these requirements satisfactorily is 10 to 12 inches.

Since, in most cases, the feeder system is suspended from one end of the antenna itself, all unnecessary weight should be eliminated. This means that the spreaders must be of the lightest obtainable material suitable for the job, and practically puts glass rods, towel bars and the like out of the question. Wooden spreaders in the form of ¼-inch dowels boiled in paraffin are quite satisfactory, or ready-treated pieces of "printer's furniture", which may be obtained in ⅜" by ⅝" by 3 foot strips from a printers' supply or job printing establishment, may be used. Spacers should be placed about every five feet and rigidly connected to the feeder wires.

The feeders should be made up of wire of the same gauge as that of the antenna wire, because the current at the antinodes in the feeders will be of the same order of value as at the current antinodes in the antenna. Number 12 enameled solid cop-

per wire is quite satisfactory both on this account and also because it possesses sufficient rigidity to prevent its whipping about in the wind as lighter wire would have a tendency to. If possible, the feeders should be supported on the side of the building, ridge-pole or mast at any convenient point by stand-off insulators, as this permits stretching the wires taut and also removes a proportionate amount of the load from the antenna, ropes and guys.

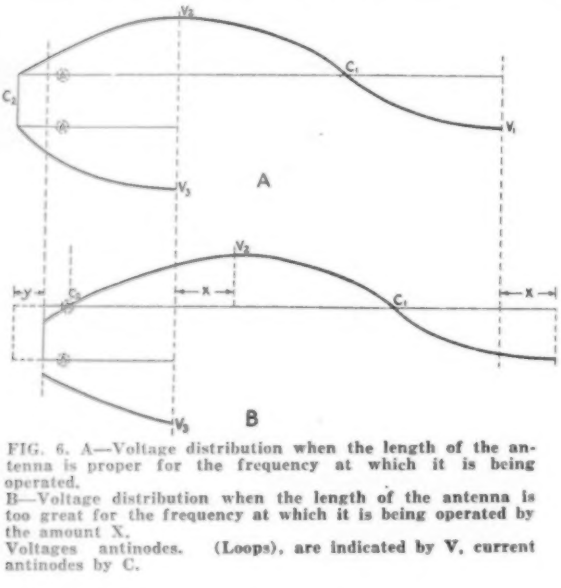


FIG. 6. A—Voltage distribution when the length of the antenna is proper for the frequency at which it is being operated.
B—Voltage distribution when the length of the antenna is too great for the frequency at which it is being operated by the amount X.
Voltages antinodes. (Loops), are indicated by V, current antinodes by C.

TUNING THE FEEDER SYSTEM

Our radiator now swings in the aforesaid free space. The feeder system drops in a more or less graceful catenary to the lead-in bushing and thence to the antenna inductance with its associated tuning device. The transmitter is adjusted to the frequency which we intend to use and is "rarrin to go". But before we can get the desired amount of energy from the output circuit of the transmitter to the antenna, the feeder system must be tuned to do the job.

Take another look at the table of Figure 5, and note the tuning arrangement recommended for the length of feeder we are using at the frequency on which we are to work. Suppose it is the parallel type. Set the feeder tuning condenser at maximum capacity, (250- or 500-μμfd.). Turn on the filament and plate supply to the transmitter and step on the key. Swing the tuning condenser from maximum down until the antenna ammeter shows signs of life and the plate mils climb up to a satisfactory value. If the input is not sufficient at the point of maximum antenna current, (resonance) tighten the coupling between the feeder input and transmitter output coils, and repeat the tuning process. The feeder tuning condenser should not be so adjusted as to give maximum antenna current and plate input, but should be set at a point off resonance where the antenna current is about 85% of the maximum obtainable. This will give the stable operation, steady frequency and general all-around operating characteristics demanded of the antenna system for 1929 conditions.[4]

If the series tuning arrangement is the one required, the process is the same, both tuning condensers being adjusted from maximum down simultaneously and kept "in step". The frequency should now be checked with a meter, and a slight readjustment made all around if the tuning of the feeder system has unduly upset the adjustment of the transmitter. The two feeder r.f ammeters should now indicate approximately equal values of current. If the difference in the two readings is greater than about 10 percent, the length of our radiator is probably too great, and a process of pruning is in order.

CHECKING THE LENGTH OF THE ANTENNA

A short review of the voltage and current distribution in the feeders and antenna under the ideal and abnormal conditions may be in order. Figure 6 illustrates A, the voltage distribution when the length of the antenna is correct for the frequency at which we wish to operate; and B, the voltage distribution when the length of the antenna is too great for the frequency at which we wish to operate. There will always be voltage antinodes (loops) at V_1 and V_3 of both A and B, as these are the extreme ends of the whole system. This will always be true when there is a state of oscillation. A voltage antinode is also to be desired at a point directly opposite V_3, and this we have at V_2 in A. In B, however, the antenna is too long for the fre-

(Continued on Page 86)

4. *Overhauling the Transmitter For* 1929, by Ross A. Hull, *QST*, Aug. 1928. It has been usually found that a better note, denoting more constant frequency, is obtained with the feeder circuit tuned below the resonance frequency or with the feeder tuning condenser set at a higher value of capacity than at resonance. Some exceptions have been noted however, the note being better in several cases with the tuning condenser set at a lower capacity value. This setting should be checked by listening to the signal via a monitor or shielded receiver.

The Fifth Age

By W. A. Adams*

I AM not going to sa that ham radio is the bunk, but when you buy a new fifty watt bottle after using a seven and a halfer fer a long time and then onli get one tenth amp less radiation it doesn't go over like a R 8 report in South Africa. Its all right fer these big boys like 6AM and 6HM to throw the cow's husband about radiation don't count fer nothing, but that kinda stuff just qsy's over my head. I am one o those kind a guys that try to watch the amp meter move until you almost see it going around in a circle. That no radiation is o.k., but me fer the big swing on the ammeter needle. Which all goes to prove that I was getting mighty disgusted when after buying a fifty I found to my pleasure that I was getting abt one amp wid a suction of 200 mills. I had onli been getting an amp and two wid 80 mills. Boy I was sure disgusted and I don't mean maybe.

When I am sore at my set I usually get out of the shack and walk around. So at this particular occasion I betook myself in the general direction of 6CLT.

"Sa om," I qsoed, "what do you do fer a amp meter that won't bedge?"

"What kind you got?" he came back.

"It is a Roller Smyth hot wire." I answers.

"Just set a candle under it," he sez, "and watch her budge. I'll go as far as to bet you get two tenths more."

"Aw. Cut the funny qrm. I just got a fifty and I get a tenth less than I got wid my seven and. I have tried every thing from cutting down the counterpoise to putting a couple thousand on the plate. I even put the R.F. chokes in backwards."

"Well," he comes back, "Budgel seems to get three amps out of his you better try—."

"Sh!" I breaks in, looking out of the window, "will you qso that neat pair of ground connections." We gazed with awe. "Sa, ain't that one hot mama. Here is where I am qrw right now." I jumps up busts out of the door and continues on my way. The mean YL was abt a half a block ahead of me and I aimed to keep that far behind until I found her qrd. About two blocks more and she speaks to a boy friend, and I'll be blessed if it isn't my old friend CBY. A hi does the trick and one minute more and I am qso the boy friend.

"Who in the world is that mama?" I sez, jerking my head in the general direction of the fast disappearing YL. I knew that CBY was hogtied so no danger from any qrm.

"That's Helen," he comes back," Don't you know her? She lives down in your neighborhood."

"I don't," I returned, "but I sure craves a qsp. Hw abt it?

"Sure thing," he sez, "I will be over to your house tomorrow when she goes by. Anything to help another ham."

"Gee your anxious," I sed, "do you know her too well or have I been qrming you pretty bad?"

"Neither," he sez, but I was suspicious. Maybe that fifty was making more noise than I thought it was. Maybe 6HM was right after all. Nevertheless he was over to the shack next afternoon, and after he had exhausted every means of getting more radiation without putting in a killowatt, we qsy's to the front porch and the YL comes by. Everything was working to sked so far.

As the YL comes by he puts out a nice cq.

"Hello, Helen," he sez. Miss Helen turns around and we become qso. "Sa," he continues, "I want you to meet my good friend Bill or Annie as he is commonly known."

"Hello, Annie," she sez with a voice that sounds like crystal control. "I am very glad to meet you."

"Your not half as glad as I am," I says real truthfully. Then an idea pounds in like a ton of bricks, fer the om is abt as slow as a bug wid all the weights off. "Aren't those books awful heavy?"

"Well," she comes back, "they aren't very light."

"Let me carry them for you," I sez, "I was just going down to the store." I just remembered that my ma had asked me to get a can of prunes the day before, and gone after them herself.

She looks me over but I don't crack a smile, and she hands them over.

"Sure sorry you have to go so soon." I sez to CBY and I begins to walk off wid Helen. But I notices a smile around his lips, and so I looked around when we had gone two or three steps and I see him laughing fit to kill. Right off I confirms my suspicions that something is not so good

6ANN, 1148 E. 17th St., Long Beach, Calif.

(Continued on Page 90)

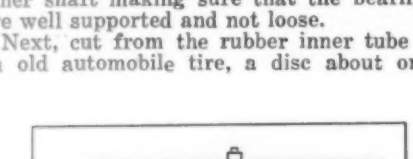
Synchronism

By C. Francis Jenkins*

MANY of those who are receiving our transmissions of radio-movies are having difficulty in rotating their disc in synchronism with the transmitter disc so I should like to make a suggestion.

Your disc is probably already mounted upon a motor shaft and if you have another motor it may be left there. If, however, you have only the one motor, it will be necessary to mount the disc on some other shaft making sure that the bearings are well supported and not loose.

Next, cut from the rubber inner tube of an old automobile tire, a disc about one-fourth the diameter of your scanning disc. For a 48-hole, 12-inch disc, a 3-inch rubber disc will be about right. Put this disc between a pair of 2-inch diameter flanges that are to be mounted on the motor shaft.



SHOWING THE GENERAL ARRANGEMENT OF DRIVING MOTOR AND SCANNING DISC.

The driving motor shaft should be at the same level as the shaft on which the disc is mounted so as to reduce slipage. The motor is mounted at an angle to the scanning disc so that it will usually be smaller than the breadth of the motor.

The motor should then be mounted on a board that can slide between guide strips on the platform that holds the scanning disc. The position of the motor should be such that in the case of a 1725 r.p.m. machine to drive a disc at 900 r.p.m., the friction wheel should touch the disc at a point about three inches from the center. Now, by means of a screw adjustment, the position of the motor board may be shifted so the correct speed is obtained. As the friction disc approaches the center of the scanning disc, the speed of the scanning disc will increase.

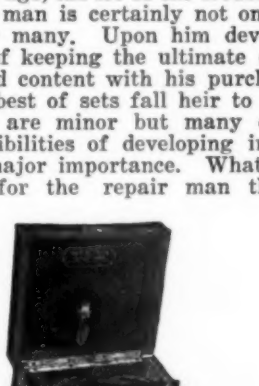
It is not advisable to use more than two friction discs cut from the average thickness of inner tubes and in most cases, one thickness will be best. Although the disc will chatter a bit at starting, it will be found quite simple to obtain and hold synchronism after the disc is up to its running speed.

Don't use a rheostat in the driving motor circuit to control its speed; let it run at the speed for which it was designed as this will result in greater constancy. Most any size of motor will do providing it is not too small; a 1/20th, 1/16th or 1/8th horsepower motor revolving at about 1725 r.p.m. will work well with scanning discs up to 12 or 15 inches in diameter.

* 1519 Connecticut Ave., Wash., D. C.

Radio Set Tester

IN this day when the average radio receiver is operated from a variety of sources, employs tubes that differ widely in their characteristics and circuit arrangements that are vastly more complex than one would have thought practical a few years ago, the lot of the trouble shooter or repair man is certainly not one that is envied by many. Upon him devolves the problem of keeping the ultimate consumer happy and content with his purchase, for, even the best of sets fall heir to ills most of which are minor but many of which have possibilities of developing into problems of major importance. What is more valuable for the repair man than test equipment which will allow him to put a set through its paces in the shortest amount of time? The diagnosing of trouble should be but incidental to the correcting of it.



The instrument shown in the illustration is a versatile device that may be used to check almost all parts of *any* modern receiver without the use of a great deal of thought or time on the part of the operator. It is equipped to measure direct voltages as high as 600 or less than a volt, regardless of whether they are obtained from

(Continued on Page 70)

Remodeling the Traffic Tuner for 1929

Opening up the scale of the Autodyne not only for this year but for next year's conditions

By Harold P. Westman, Technical Editor.

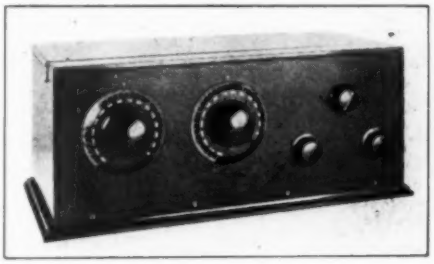
IT should perhaps be stated at the outset that the receiver to be described is not the result of the organized "Technical Development Program" that is being prosecuted by the League. It is merely my own opinions as to some receiver characteristics that should be desirable for operation primarily in 1929 but with a thought towards making the set satisfactory for the remainder of this year. When the transition occurs, a comparatively small amount of work will allow the tuning ranges to be modified to meet the newer conditions.

We are at present doing practically all of our communicating within three bands: the 3500-, 7000- and 14000-kc, bands in which there are a total of 3500 kilocycles. What is left of these in 1929 will encompass but 1200 kilocycles and it behooves us to use all the territory open to us. Our 1750-kc. band will contain 285 kilocycles and while transmission over large distances when employing low-powered transmitters is not as good there as it is in the 3500-kc. region, it should be very satisfactory for distances not in excess of 250 miles or so. Traffic networks, where the distance between stations is small, could be established there and the reduction in the amount of interference encountered should help considerably in getting traffic through. Any receiver suitable for 1929 should, then, be capable of covering the 1750-kc. band as well as the other three more popular ones.

Our new 28000-kc. band has offered some possibilities, in that communication over comparatively short distances has been established. We would be very foolish not to make extensive tests to determine just how effective these frequencies are for our purposes. This gives us five bands that must be covered if we are to make ready for 1929 conditions. While it would be nice to cover also the 56000-kc. band, this does not seem to be thoroughly practical from a constructional point of view. and it would seem best to build a separate receiver (probably of the double-detection type) for this band.

The simplest method of constructing a receiver to cover all five bands would be to use a size of condenser that allowed that band to be covered which required the largest capacity range and let the other ranges fall where they may. However, there wasdescribed in the April, 1927, issue of *QST*, under the heading of "A Traffic Tuner," a receiver that spread each band over practically the entire tuning dial scale. After handling such a set one simply hates to go back to receivers which resemble a New York subway. The subway gives you lots of space between trains but precious little within them; so does the average set treat the amateur bands.

As the name implies, the "Traffic Tuner" was primarily devised for the benefit of the traffic handler who must be capable of making and keeping schedules even though conditions be poor. This requires a set that spreads the particular band in



ALL PRETTIED UP

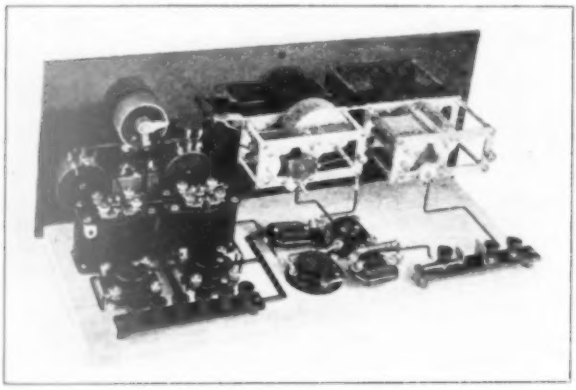
which operation is desirable over a large portion of the tuning dial so that tuning, even with a comparatively fast motion dial which allows the band to be searched quickly will not be abrupt and critical. In the second place, the regeneration control must not have too great an effect upon the tuning. Thirdly, it should be possible to log signals and assuming that the signal frequency has not been changed to be able to go back and pick them up without wasting too much time. Sensitivity and stability must, of course, not be sacrificed.

A receiver built with these points in mind might answer many of our 1929 troubles and if it didn't, it would at least give us a start towards meeting them. That in itself is well worthwhile.

The older tuner employed a conventional type of tuning condenser which goes from minimum to maximum capacitance with a rotation of 180 degrees. In this one, a National "equicycle" condenser which is rotated

270 degrees to cover its range is used. A gain of 50% in dial space results.

The capacity change needed to cover the 1750-kc. band as indicated by the tables in the Handbook is several times that required to tune across the 14000-kc. band. This makes the use of a single capacity range rather hopeless and two condensers of different ranges are necessary. Fortunately it is a simple matter to convert the National condenser for the job.



THE INNARDS.

The clip that is holding onto the tie rod of the tuning condenser is connected to the larger section. When both sections are to be used, it is clipped onto the machine screw supporting the smaller capacity section. The antenna tuning coil is not shown.

There are two types of National equi-cycle condensers. The older is the one which is built into the set while a photograph of the newer type is shown separately. The plate shape and spacer thickness is the same for both types so no trouble should be encountered from this angle. The main difference is in the type of frame used to support the plate assemblies.

In converting the unit for use in this receiver, the stator plates are removed as well as the rods on which they are mounted. It will not be necessary to take the frame apart for this operation unless the threading on the rods does not extend far enough to allow one end of the rod to be worked back through the insulating piece.

The rods removed may be cut in half and employed to support the two new stator assemblies or else they may be replaced by four 6/32 round headed brass machine screws about 1½ inches long. One of these assemblies which will be used for the higher frequency bands employs a single stator plate and exposes one side of it to the first rotor plate. The spacing between these two plates is very important and it should be adjusted so that with the proper coil, it just covers the 14,000-kc. band with enough overlap to take care of capacity effects due to antenna coupling which may be changed and which shifts the tuning slightly. In the particular set being described, more overlap was allowed than is absolutely necessary so that there should be no great difficulty in duplicating the ranges even though the capacity effect of the wiring, etc., should differ by much in other sets. As a rough adjustment when reassembling the condenser, make this spacing the equivalent of the thickness of eight *QST* pages. The final adjustment will be made when the set is in operation.

The other section of the condenser may consist of a single plate or if double spacing is thought desirable two stator plates should be used. It is mounted on a pair of machine screws and placed between two of the rotor plates. For convenience in wiring, the smaller capacity section is assembled to the back of the unit and the other at the front nearest the panel and dial. The smaller section will be wired into

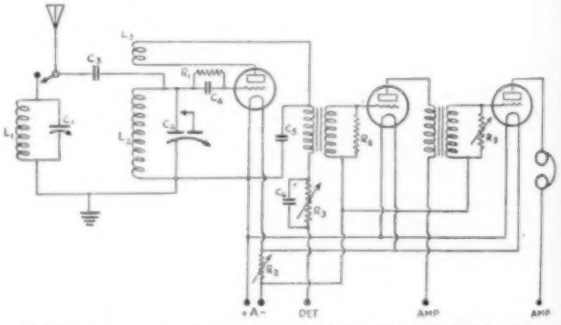
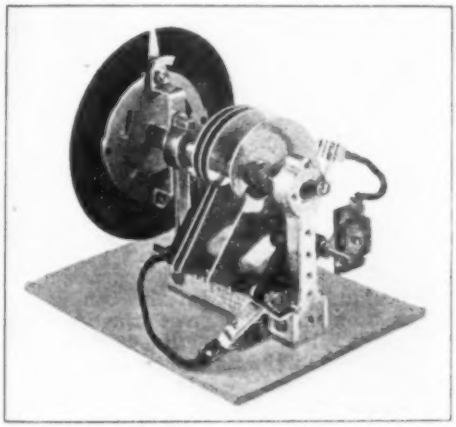


FIGURE 1. THE SCHEMATIC DIAGRAM OF THE SET.

C1—350 μμfd. variable.
C2—Described in text.
C3—Described in text.
C4—100 μμfds.
C5—2000 μμfds.
C6—.1 μfds.
R1—7 megs.
R2—10 ohms or more.
R3—Frost 50,000-ohm variable.
R4—.1 to .25 megs.
R5—Frost 500,000-ohm variable for volume control.
L1 will vary to suit the antenna and L2 and L3 are described in the text.

the circuit permanently while the larger section will be connected across it for the 1750-kc. band. A switch could be constructed for this change but would probably result in mechanical difficulties. To simplify matters, a piece of flexible wire was connected to the larger section stator plate and the clip on its end may be snapped onto the machine screw supporting the stator plate of the smaller section or onto the frame of the condenser thus grounding the larger section when it is not in use. It makes a workable and practical arrangement involving the use of no great amount of mechanical ability or equipment as might a more beautiful appearing switch. There is no need for its being operable from the front of the panel because it will need to be shifted only when it is desired to receive



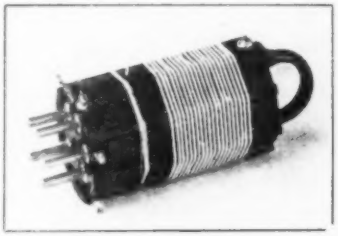
THE NEWER TYPE OF EQUICYCLE CONDENSER AND HOW IT IS CONVERTED FOR THE JOB.

It shows the larger capacity section as consisting of two stator and three rotor plates with double spacing. This section may consist of just one stator and two rotor plates with normal spacing. Neither is it necessary to remove the unused rotor plates.

on a different band and as it is necessary to change coils when making such a shift, no hardship is imposed by requiring that the clip also be changed.

The only other point to be discussed concerning the condenser is the use of the Hammarlund "neutralizing" condenser. This allows a band that is either above or below the U. S. bands to be covered so that, for instance, those foreigners working around 8330 kcs. may be received.

The circuit diagram is given in Fig. 1. It will be noted that the antenna circuit is tuned after the fashion described by R. B. Bourne on page 36 of the August issue. It allows the antenna tuning and coupling to be varied independently and if capacitive coupling is to be employed for the 1750-kc. band it is of great help in building up the signal strength. What is more important, it helps on the signal noise ration. A large tuning condenser is used and the coil should be of such dimensions that the antenna circuit will tune over the 1750-kc. band. Harmonic tuning will be employed for the higher



THE PILOT COIL FORM WITH THE 7000-KC. WINDING ON IT

frequency bands and the coil will not have to be changed for them. No switching arrangement has been provided for disconnecting the tuning circuit other than the use of an extra binding post. If such is desired, it may be installed without a great deal of trouble. If a very long antenna is used, the tuning coil and condenser may be connected in series by connecting the coil across the two antenna binding posts.

The antenna coupling condenser consists of two small brass plates. One is somewhat larger than the other (it happened to be available and was not cut down) and the smaller is approximately ½ inch square and is soldered to a piece of heavy bus bent in the form of a "U", the sides of which pass under the head of a binding post. Spacing up to an inch and a quarter may be had. Coupling should be made loose and the two stage audio amplifier relied upon for obtaining good signal strength. The looser the coupling the less effect will the antenna tuning have upon the calibration of the tuning dial and the less need there will be for using the regeneration control.

The coils are wound on Pilot forms, one of which is shown next to the tuning condenser. When using such small tuning capacities, one really begins to appreciate the tuning effect the tickler coil has upon the circuit. In the 14,000-and 28,000-kc. bands, it is possible to shift the tuning very materially by changing the number of tickler turns by one, this with tickler coils of No. 30 s. s. c. wire. The tickler seems to give the smallest effect on loading the secondary circuit and detuning it when the least number of turns is employed. The coils were wound about ⅛ of an inch below the filament end of the secondary winding and the turns reduced one at a time until the circuit would not oscillate over the entire range of the tuning condenser. After the minimum number of turns was obtained,

the winding was shifted away from the secondary until the loosest coupling was obtained without causing the regeneration control to become cranky and irregular. The result is a smooth control of regeneration with very slight detuning effect. The use of a large coil with looser coupling causes greater detuning.

The use of a 2000-*uufd.* by-pass condenser between the battery side of the tickler coil and filament helps materially in the problem of regeneration. A small condenser in this position makes it necessary to increase the size of the tickler coils with its accompanying troubles. As the size of the by-pass condenser is increased, it tends to by-pass more of the higher audio frequencies because it is in shunt of the primary of the audio transformer. While this may be damaging to quality in a broadcast receiver, it can be considered as an assistance in a set for receiving telegraph signals in that it tends to reduce the hissy background. It has little or no effect upon signals in the lower audio range to which they are usually heterodyned.

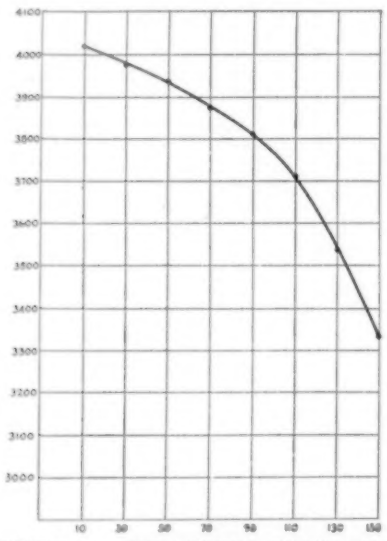


FIGURE 2. THE TUNING CURVE FOR THE 3500-kc. COIL.

It shows how the number of dial divisions for a given range will change depending upon the particular end of the scale being used.

Dry cell tubes of the '99 type are used. Since they have been equipped with long terminal prongs that make decent contact, they are not half so troublesome and are first rate as oscillating detectors for high frequency work. Fringe howl has been cured as usual by shunting a .1 or .25 meg leak across the secondary of the first audio transformer. The transformers are designed for music and so we are not discriminating against a large percentage of the signals on the air. Separate B leads are provided for the two audio amplifying tubes so that on nights when the static is very bad, the plate voltage to the first amplifier tube may be dropped to a volt or two and thus by its limiting action, one to one ratio between the signal and static can be obtained. This is a stunt that has been mentioned before in *QST* and was recently suggested again by Paul G. Watson of West Chester, Pa. The phone cords do not come to the panel at all and, therefore, won't always be getting in the way.

Coil sizes are as follows:

Band in kcs.	Coil Range	Number Turns Sec.	Tickler	Degrees to cover band 1928	1929
1500-2000	1395-2055	65.	9	106	40
3500-4000	3371-4027	46.25	5	116	116
7000-8000	6897-8000	16.25	4	133	21
	7940-9755	16.25	4		
14000-16000	13510-16300	7.25	4	114	11
	11760-13640	7.25	4		
28000-30000	27650-30380	2.25	3	40	40

The 6879-8000-kc. and the 11760-13640-kc. ranges are obtained with the shunt capacity in the circuit while the other ranges for the same coils are obtained without the shunt condenser. The value of this condenser is determined by shunting it across the tuning condenser and increasing its capacity until when with the tuning condenser at about 10 degrees, the frequency is slightly below that obtained when there is no shunt and the tuning condenser is set at 150 degrees. It would, perhaps, better be adjusted with the 14000-kc. coil which band is covered without the shunt capacitance in the circuit.

The secondary coils are wound with No. 26 d. c. c. wire excepting in the case of the 1750-kc. coil which is wound with No. 30 s.c.c. which is used for the tickler coils. The ticklers are close wound and are spaced about ⅛" from the filament end of the secondary windings. The 1750- and 3500-kc. coils are close wound while the spacing between turns of the 7000- and 14000-kc. coils is the diameter of the wire used. In the case of the 28000-kc. coil, it was found necessary to wind the secondary coil with about ⅛" spacing between turns and then wind the tickler coil between the turns. If the tickler were wound below the secondary in the usua fashion, it would probably call for at least two or three more turns which would require that the number of secondary turns be reduced still further.

Fig. 2. gives a typical tuning curve. It happens to be for the 3500-kc. band but is similar for the other range. The thing to be pointed out is that the number of divisions of dial space to cover a band

(Continued on Page 68)

Washington Developments

Commercial Assignments in Our Bands; Amateur Calls Changed; Amateur Extra First Class Operator's License Restored.

WE have previously mentioned in *QST* that 21 channels between 7300 and 8000 kc. (part of our present "40-meter" band) and 27 channels between 14000 and 14400 kc. (in our present "20-meter" band) have been assigned to commercial interests by our Federal Radio Commission, because these will not be amateur frequencies after January first and because United States stations will not get the use of them if they do not start now. Construction permits have been issued for the use of many of these channels and it is now expected that many of the stations will be in operation before the end of the year. This applies particularly to the Radio Corporation group. R.C.A. channels on which operation prior to January 1st is likely are: 7400, 7415, 7520, 7715, 14800, 14830, 14920, 15040, 15430, 15460, 15490, 15970 and 16000 kc. As these stations one by one come on the air we shall find our operating territory gradually reduced, but by the same token the foreign commercial stations now operating in the ranges 7000-7300 and 14000-14400 kc. will be moving out, for they must be clear of our 1929 bands by the first of the year.

NEW AMATEUR CALLS

As anticipated in our August issue, page 35, the Radio Division of the Department of Commerce announces that, effective October 1, 1928, all amateur, experimental and training school station calls are changed by prefixing the existing call with a letter to indicate nationality, as required by the Washington Convention. The prefix for stations in continental United States is "W", while for those in distant territories and possessions it is "K", to permit distinguishing them from continental calls of the same district. Quoting from the *Radio Service Bulletin* for June 30th:

> While the requirements of the convention are not actually effective until January 1, 1929, it has been deemed advisable to change the call signals effective October 1, next, as the Division desires to show the new signals in the annual list of Amateur Radio Stations of the United States, edition June 30, 1928, rather than to change the calls effective January 1, 1929, and publish the new calls in the June 30, 1929, edition.
>
> Therefore, beginning that date, all stations in the classes above named within the continental limits of the United States are hereby ordered to add to their call signals the letter "W", and those in Alaska, Hawaii, Porto Rico and the Virgin Islands, should add the letter "K". These letters should precede the call signal; for example, station 4ABC, if within the continental limits of this country, becomes W4ABC and, if in Porto Rico, becomes K4ABC.

It is important to note that the prefixes "W" and "K" are *not to be used before October first.* On that date, however, their use commences, with the old intermediate "de" and the abandonment of "nu".

In passing, let us mention again that every amateur ought to subscribe to the *Radio Service Bulletin.* It contains much important information. It cost sbut 25c per year (stamps not accepted), from the Superintendent of Documents, U. S. Government Printing Office, Washington.

Aside from the fact that Canada is going to use the letters "VE", we have no reliable information on the prefixes that other countries will use for their amateur calls. As it does not seem likely that we will have a complete list before the year is out, we print below the international table of allocation of call signals from the Washington Convention. Nations are obliged to select some letter or letters from their assignment to use as a prefix to amateur calls, but we can not tell at this date what they will be. Where a nation is given all combinations beginning with a given letter, as in the case of "W" for the United States, that single letter will suffice; but where a letter is partitioned amongst several countries, like "Z", two letters will be necessary. One cannot say to-day, for example, whether New Zealand amateurs will use the prefix "ZK", "ZL" or "ZM". This list, therefore, is of no aid in making calls but will be helpful in determining the identity of calls heard.

Chile	CAA-CEZ
Canada	CFA-CKZ
Cuba	CLA-CMZ
Morocco	CNA-CNZ
Bolivia	CPA-CPZ
Portuguese colonies	CRA-CRZ
Portugal	CSA-CUZ
Roumania	CVA-CVZ
Uruguay	CWA-CXZ
Monaco	CZA-CZZ
Germany	D
Spain	EAA-EHZ
Irish Free State	EIA-EIZ
Liberia	ELA-ELZ
Esthonia	ESA-ESZ
Ethiopia	ETA-ETZ
France and colonies and protectorates	F
Great Britain	G
Hungary	HAA-HAZ
Switzerland	HBA-HBZ
Ecuador	HCA-HCZ
Republic of Haiti	HHA-HHZ
Dominican Republic	HIA-HIZ
Republic of Colombia	HJA-HKZ
Republic of Honduras	HRA-HRZ
Siam	HSA-HSZ
Italy and colonies	I
Japan	J
United States of America	K
Norway	LAA-LNZ
Argentine Republic	LOA-LVZ

Bulgaria	LZA-LZZ
Great Britain	M
United States of America	N
Peru	OAA-OBZ
Finland	OHA-OHZ
Czechoslovakia	OKA-OKZ
Belgium and colonies	ONA-OTZ
Denmark	OUA-OZZ
Netherlands	PAA-PIZ
Curacao	PJA-PJZ
Dutch Indies	PKA-POZ
Brazil	PPA-PYZ
Surinam	PZA-PZZ
U. S. S. R. ("Russia")	RAA-RQZ
Persia	RVA-RVZ
Republic of Panama	RXA-RXZ
Lithuania	RYA-RYZ
Sweden	SAA-SMZ
Poland	SPA-SRZ
Egypt	SUA-SUZ
Greece	SVA-SZZ
Turkey	TAA-TCZ
Iceland	TFA-TFZ
Guatemala	TGA-TGZ
Costa Rica	TIA-TIZ
Territory of the Saar Basin	TSA-TSZ
Hedjaz	UHA-UHZ
Dutch Indies	UIZ-UKZ
Luxemburg	ULA-ULZ
Kingdom of the Serbs, Croats and Slovenes	UNA-UNZ
Austria	UOA-UOZ
Canada	VAA-VGZ
Commonwealth of Australia	VHA-VMZ
Newfoundland	VOA-VOZ
British colonies and protectorates	VPA-VSZ
British Indies	VTA-VWZ
United States of America	W
Mexico	XAA-XFZ
China	XGA-XUZ
Afghanistan	YAA-YAZ
New Hebrides	YHA-YHZ
Iraq	YIA-YIZ
Latvia	YLA-YLZ
Free City of Danzig	YMA-YMZ
Nicaragua	YNA-YNZ
Republic of El Salvador	YSA-YSZ
Venezuela	YVA-YVZ
Albania	ZAA-ZAZ
New Zealand	ZKA-ZMZ
Paraguay	ZPA-ZPZ
Union of South Africa	ZSA-ZUZ

EXTRA CLASS LICENCE RESTORED

Attention is here called to the kind restoration, by the Radio Division, of the Extra First Class Amateur Operator License. All Supervisors of Radio are now prepared to issue this license. For further particulars our editorial this month should be consulted.

TELEVISION FREQUENCIES

It is expected that a generation order will issue from the Federal Radio Commission in the very near future, authorizing amateurs to experiment with picture transmission and television transmission within the frequency bands 1715-2000 kc. and 56,000-60,000 kc. (the "160-meter" and "5-meter" bands) but within these two bands only. This has no reference to the frequencies used by broadcasting and experimental stations for popular consumption, but refers only to transmissions by amateurs themselves.

THE GOVERNMENT CALL BOOK

Amateurs are not adequately supporting the very splendid call book, *List of Amateur Stations of the United States*, published annually by the government for the modest sum of twenty-five cents. Only about 5,000 copies are sold annually. With 17,000 amateurs in this country there should be bigger support. It costs the Radio Division over $3,000 of their appropriation to have this list made available for popular sale, and unless there is more evidence that the list is in demand the Division may discontinue its publication.

The book will appear in September or October and will be complete to June 30th. It is accurate, and it deserves our support. The Radio Division having paid the entire cost of composition, the 25c charge represents only the cost of paper and handling. Orders should be addressed to the Superintendent of Documents, Government Printing Office, Washington, and remember that stamps aren't accepted. Last year some purchasers were erroneously advised that the supply was exhausted and their money was returned, but this year we are assured of an ample supply.

CHANGES IN ALABAMA

On July 1st the Radio Division, for administrative convenience, transferred the state of Alabama from the Fifth District to the Fourth District, under Major Van Nostrand at Atlanta. This necessitated the changing of Alabama amateur calls from 5s to 4's. Applications were sent all amateurs early in June and 4th-district licenses, dated July 1, were issued as fast as applications came in, so that those who responded promptly will be correctly listed in the June-30th issue of the government call book. In many cases the same combinations of call letters were given the stations; in other cases two- or three-letter calls were given them according to what they had while in the Fifth District. Major Van Nostrand kindly supplies us with the following list of Fourth District calls in Alabama to July 9th:

W4GP	John McCaa	1025 Fairmount St., Anniston
W4AHN	Paul Brake	Auburn
W4AHQ	Vernon V. Story	41 W. Magnolia St., Auburn
W4AIN	John L. Cauthen	Auburn
W4JB	Cecil L. Thomas	227 Magnolia St., Auburn
W4AAH	Basil Payne	105 Vine St., Birmingham
W4AHT	Hardy D. Carl, jr.	4141 39th Ave., N., Birmingham
W4AHW	Francis M. Greene	1400 N. 30th St., Birmingham
W4AHX	Elmer McCurdy Prather	2721 Bessemer Blvd., Birmingham

W4AIB	George Woods Fahrubel	500 Miller Ave., Birmingham
W4AIE	Leonard William Thomas	115 Kate Ave., Birmingham
W4AIM	Hdqrs. Co. 3rd Bat., 167th Inf., Ala. Natl. Guard	1800 2nd Ave., Birmingham
W4AX	Joe Wheeler Clancy	1316 17th St., S., Birmingham
W4CD	Alabama Natl. Guard, 106 Obsn. Sqdn., Air Corps	Roberts Field, Box 570, Birmingham
W4DS	William Alonzo Boon	216 Pine St., N. West End, Birmingham
W4GG	Edward Florien Herzog	1007 Crescent Ave., Birmingham
W4HI	D. J. Connolly	1530 N. 20th St., Birmingham
W4JY	I. J. Jones	1538 11th Ave., Birmingham
W4MY	Wendell H. Binkley	1400 30th St., N., Birmingham
W4OM	Walter Martin Garrard	1430 N. 12th Court, Birmingham
W4RE	H. L. Ansley	1428 N. 12 Ave., Birmingham
W4VC	M. B. Drennen	510 St. Charles Ave., Birmingham
W4AHZ	Leonard C. Kron	1719 29th St., Ensley
W4AIO	Aubrey Whitney	Fayette
W4UV	Julius Clarence Vessels	Fayetteville
W4AIA	Arthur & Viola Hook	P. O. Box 127, Foley
W4ET	Robt. L. Brackett	Ft. Morgan (Mail c/o United Fruit Co., Mobile)
W4AID	Raymond N. Jones	903 S. 10th St., Gadsden
W4PAR	Joseph E. McCormack	246 S. 5th St., Gadsden (Portable)
W4RC	Joseph E. McCormack	246 S. 5th St., Gadsden
W4ACX	James I. Kelly	Hazen
W4AHY	J. W. Hudgins	104 Oakwood Ave., Huntsville
W4MB	Wilton H. Pollard	104 White St., Huntsville
W4SN	Charles Forrest Striplin, Jr.	724 E. Clinton St., Huntsville
W4AAS	Thomas Joseph Peddy	Loachapoka
W4AAJ	Chas. E. Emrich	55 S. Joachim St., Mobile
W4OA	James Robertson	264 N. Conception St., Mobile
W4WS	Norman Sinclair Hurley	960 Marine St., Mobile
W4AAQ	Samuel Jefferson Bayne	108 Cramer Ave., Montgomery
W4AHO	Alexander D. Trum	217 Catoma St., Montgomery
W4AHP	Robert Edward Troy, Jr.	516 Cloverdale Road, Montgomery
W4AHR	Andrew C. Kilpatrick	R.F.D. No. 4, Montgomery
W4AHS	John Brown	1404 Church St., Montgomery
W4AIP	Julian Maurice Gantt	24 Capitol Parkway, Montgomery
W4AN	John Cravens Howell	5 Woodward Ave.
W4AHU	Basil B. McGinty	River View
W4AIH	Terry L. Geurrant	803 Lawrence St., Selma
W4AIL	Henry W. Fulwider	515 Sylvan St., Selma
W4DJ	William H. Dent	816 Union St., Selma
W4FN	Walter W. Merkle	835 King St., Selma
W4IA	L. Tennett Lee, Jr.	232 Lamar St., Selma
W4PAS	R. B. Sommerville	111 Alabama St., Selma (Portable)
W4TH	Karl William Bewig	706 Broad St., Selma
W4TI	R. B. Sommerville	111 Alabama St., Selma
W4VX	Carroll M. W. Engelbert	1005 First Ave., Box 834, Selma
W4AIK	Leslie B. Stanton	1024 15th St., Tuscaloosa
W4AHV	Ralph A. Owen	610 McClain Ave., Tuscumbia
W4AIC	Earl Campbell Schrimsher	4833 6th Ave., Wylam

SUPERVISOR KOLSTER COMMENDS US

In the annual report of the Supervisor, First District, to the Radio Division, Supervisor of Radio Kolster comments as follows under the subject of "Interference":

"I wish to bring to the attention of the Division the splendid coöperation extended to this office by the amateurs who volunteered their services in connection with this investigation work".

We're proud of that.

CAPTAIN HOOPER NOW D. N. C.

Captain S. C. Hooper, in charge of the radio section, Bureau of Engineering, U. S. Navy, and lately assigned as Technical Advisor to the Federal Radio Commission, has been appointed Director of Naval Communications at Washington, relieving Capt. Thos. T. Craven, who has been promoted to Rear Admiral and transferred, we believe, to sea duty. Like Admiral Craven before him, Capt. Hooper is a splendid friend of the amateur. He has known us longer than any of his predecessors in that office. Although known to amateurs as one of the joint revisors of the well-known *Robison's Manual*, he must be best known as one of our most helpful friends at the Washington international conference—see January *QST*. Our congratulations and best wishes to both officers!

—*K. B. W.*

Strays

If you substitute for the crystal a wavemeter or any tuned circuit, tuned to the same wavelength as the crystal, during the "tuning up" process, you will not be so apt to have a crystal "transmitter" and a broken crystal when it comes time to work the set. After all the preliminary adjustments have been made, the crystal can be put back in the circuit.—3CKL

A description of their line of uniform-size meters for transmitters, and some dope on the uses of various meters, is in the Weston Electrical Instrument Corp. new circular J. Better get one.

Experimenters' Section

THE members of the Experimenters' Section, together with the rest of the amateur fraternity, are faced with the big problem of meeting the more or less drastic change in operating conditions which the inauguration of the provisions of the International Radio Conference of 1927 will bring upon us January first of next year. We have never been licked by frequency restrictions before, and we are not going to be licked this time. It is quite obviously not only expedient but also necessary that the body of experimenting amateurs concentrate their activities on the technical phase of preparing to cope with the not far away situation, and that the Experimenters' Section as the organized body of these experimenting amateurs tackle those technical problems bearing most directly on the approaching situation.

CONCENTRATING ON PROBLEMS TO MEET 1929 CONDITIONS

With this viewpoint in mind the list of X Section problems has been somewhat modified. While most of the old problems have been retained, the scope of several has been enlarged and several new problems have been added. Four problems have, for self evident reasons, been eliminated. The present list of problems is as follows:

THE ANTENNA CIRCUIT

A10-Antennas and feeder systems.
A12-Loop transmission and reception.
A13-Underground antennas.

RECEPTION

R12-Radio frequency amplifiers for amateur bands.
R13-Methods of obtaining audio frequency selectivity.

TRANSMISSION

T25-Radio frequency chokes for transmitters.
T26-Keying methods.
T27-Transmission and reception on 28,000 Kc., (10 meter), band including antenna systems.
T30-Transmission and reception on frequencies above 56,000 Kc., (wavelengths below 5.357 meters).
T33-Constant frequency transmitters .

Glancing over the list, it is seen that A10 has been enlarged to specifically include feeder systems, while A12 and A13 are as before. Receiving problem R12, while specifically mentioning radio frequency amplifiers, actually encompasses every type of receiver including the superheterodyne. R13 is a new addition, and one which is undoubtably to prove of great value in adapting receivers to 1929 conditions.

The transmitting problems T25 and T26 are unchanged, while old problem T27, having outlived its usefulness, has been replaced by new problem T27 made necessary by opening of the 28,000 kc. band. T28, portable Transmitters, has proven more the question of mechanical design in adapting a low power transmitter for portable use than a real experimental problem, and has therefore been eliminated. T30 and T31 have been combined as T30, while T32 has been enlarged to include all constant frequency transmitters as T33. General problems G12 and G13 are so obviously general in their nature and remote from the big problem before the amateur at this time that they have been eliminated.

Due to the wide scope of each problem and the desirability of having each experimenter concentrate to the greatest possible extent on the problems he may select, not more than TWO problems are to be chosen from the list by each member.

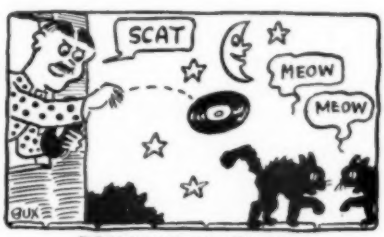
If at some future time, however, the experimenter should decide to substitute a different problem for one first chosen, he may do so by writing Headquarters, advising the change.

Experimenters at present enrolled for problems which have been discontinued on the new list should not drop their activities on these problems, but should continue to a conclusion and report on these problems as usual.

Outlines suggesting a method or methods of attack on the problems as well as a list of references of material are being prepared for each problem and will be sent to members enrolled for the respective problems as soon as the preparation is completed.

There is work to be done by every experimenting amateur now as never before, and new members for the Experimenters' Section are needed and wanted. All desiring to be enrolled should do so at once—just address the Experimenters' Section, American Radio Relay League, 1711 Park St., Hartford, Conn., and state that you wish to join the X Section.

—*J. J. L.*



BROADCASTING RECORDS

Mica Condensers For High Frequency

By Arthur M. Trogner*

A recent article in *QST* gave some explanation of the necessity for symmetrical arrangement of condenser units when used in parallel in high frequency transmitting circuits. This is no new conception or principle, but, like a lot of other fundamental rules it is of such small moment in intermediate and low frequency circuits that it can usually

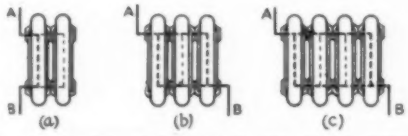


FIG. 1. THE THICKNESS OF THE DOTTED LINES THROUGH THE CONDENSERS SHOWS ROUGHLY HOW THE CURRENT WILL DISTRIBUTE ITSELF

be neglected there. In the high frequency field the effects of a neglect of this principle of symmetry will not be pleasant unless your pocket-book is well lined and you delight in making business for the small condenser makers.

What is meant by this symmetry can best be explained by first showing what *not* to do and why. Fig. 1 shows several common methods of connecting small fixed con-

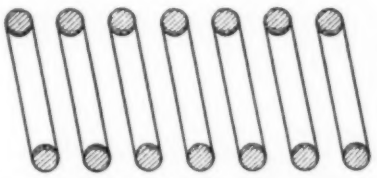
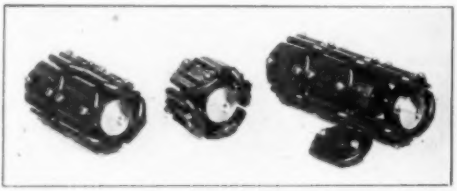


FIG. 2. SHOWING THE DISTRIBUTION OF THE CURRENT IN A COIL WOUND WITH ROUND CONDUCTOR

Of course, there will be some current flowing at the outer surface and even in the center but the percentage of the total current which flows along the inner surface will increase as the frequency is increased.

denser units in parallel when greater current carrying ability, greater capacity, or both are desired. It is obvious that the paths from "A" to "B" in 1 (a) are not the same length through both condensers. From your own work with high frequencies you know what an appreciable difference in inductive reactance such small differences in physical circuit length may mean. This difference in inductive reactance will force most of the current to flow through the lower reactance path and very probably burn out that condenser. In the figures the different thicknesses of the dotted lines indicate (very approximately only) the proportion of the total current which will flow through each condenser in the various arrangements. If you are counting on using nearly the full current carrying capacity of each condenser in the combination, it is easy to see that burnt-out condensers will be the result. Adding more condensers in parallel such as 1 (b) and 1 (c) even though the physical lengths of the separate paths may be the same will not cure the trouble to any appreciable degree since the



GROUPS OF FOUR CONDENSERS MOUNTED IN PARALLEL SHOWING A SINGLE GROUP AS WELL AS TWO AND THREE GROUPS IN SERIES

outside condensers will still carry most of the current for the same reason that high frequency currents are crowded to the surface of a conductor on which they are traveling. The inside condensers, or the inside of the wire, are paths of higher inductive reactance than the outside and radio frequency currents always travel in the path of least inductance even though this results in higher circuit resistance. Another example of this is shown in Fig. 2 which shows roughly the character of the current distribution in the conductor of a coil carrying high frequency current. The current is crowded to the inside surface of the wires since the outer surface of the turns, being cut by more lines of force, has a higher inductive reactance. This will be easy to see if you remember that the inner surfaces are cut by the flux which is inside the coil, whereas the outer surfaces are cut by this same flux plus the flux which distributes itself between the inner and outside surfaces of the wire. (See Morecroft, *Principles of Radio Communication*, page 125 first edition or page 156, second

*Formerly at U. S. Naval Research Laboratory. Now with Wired Radio Inc., New York City.

edition.) This is one reason why coils wound with flat copper strip are so effective for high frequency work; there is not a lot of useless copper on the outside of each turn to cause eddy current losses.

This leads us to the right way to connect condensers in parallel. Put each condenser unit in a path of equal inductance. This is shown in Fig. 3 for various combinations. We have tried this out and know that it is worthwhile every time. With such arrangements, each condenser will carry its share of the load. Of course, each condenser in any parallel combination should be at least of the same rated capacity otherwise the difference in capacitive reactance thus formed will cause more current to flow through the larger capacities and might overload them. It might be well to point out here that the usual difficulty with condensers at these high frequencies is not voltage breakdown but heating and failure of the dielectric.

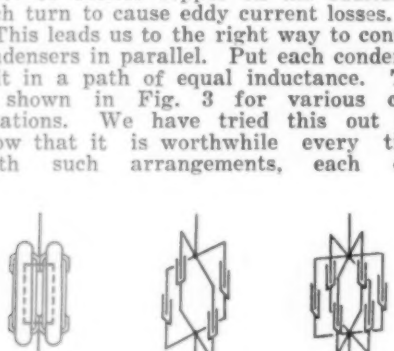


FIG. 3. HOW CONDENSERS SHOULD BE CONNECTED IN PARALLEL TO OBTAIN EQUAL DISTRIBUTION OF CURRENT THROUGH ALL THE UNITS

FOR THE 20-KW. TUBES

This group employs the same principles as do the smaller units although it has been necessary to change the mechanical arrangement somewhat. This unit has ten condensers in parallel with five sets in series. It is made up of 200 mmfd. units which are built to stand a test voltage of 5,000 d.c. The total combination has a capacity of 400 mmfds. and has been tested to 35 amperes at 18,000 kcs. It is only needed where 10- or 20-kw. water cooled tubes are being used.

In Fig. 4 is shown detail dimensions of standard parts which have been found very useful here at the Laboratory. These parts provide for 4 units in parallel and by using the ring fittings shown, such parallel units can be readily arranged with 2 or more sections in series where needed to take care of high plate voltages, and the like. Fitting of similar construction are employed to mount six condensers in parallel.

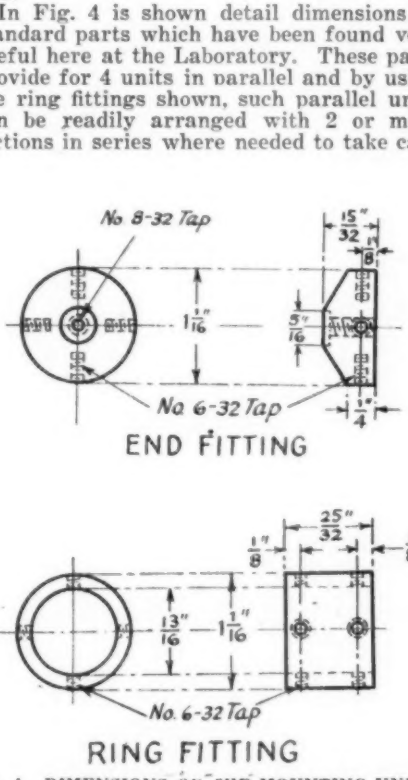


FIG. 4. DIMENSIONS OF THE MOUNTING UNITS TO CONNECT FOUR CONDENSERS IN PARALLEL

Connection to the rest of the circuit is made through 8 x 32 machine screws run into the threaded holes in the center of the end fittings. The ring fitting is employed to connect sets of four condensers in series. Several sets may be so connected making a solid mechanical as well as good electrical unit.

It might be well to add a few words about choosing the proper kind of condenser units to use. One of the benefits to "Hamdom" from the coming of the BCL is the improvement in many radio parts available on the market. Among these are greatly improved small mica condensers. Originally intended mainly for use in receivers, it has been found that the better types, constructed of the best materials to rigid standards, are just the thing for use in high frequency transmitters. Notice that I did not say that all small mica condensers are good for transmitter work.

There are many makes of condensers on the market which are all right for use in receivers, but which will not stand up under the severe loads found in transmitters. The difficulty with most condensers of this type is that their internal losses are too high. Often this is true only when the condenser is passing appreciable currents which accounts for the fact that such condensers may be good low-loss units for receivers and yet fail in transmitter use.

A suggested set of rough specifications is given below. The units should be entirely enclosed to prevent accumulation of dust and moisture across and between the edges of the mica sheets. A complete water-tight enclosure is to be preferred since only a slight amount of moisture may cause a rapid rise in losses. Condensers should be capable of carrying the currents specified in the table below without exceeding an ultimate temperature rise of 10° C above surrounding temperature.

Capacity	R. F. amps. at 6000 Kcs.
.0002 to .00059 mfd.	3 amps.
.0006 to .00099 mfd.	4 amps.
.001 mfd. and larger	5 amps.

ELECTION NOTICES

To All A.R.R.L. Members Residing in the Central, Hudson, New England, Northwestern (including Territory of Alaska), Roanoke, Rocky Mountain and West Gulf Divisions:

1. You are hereby notified that an election for an A.R.R.L. Director, for the term 1929-1930, is about to be held in each of the above Divisions, in accordance with the Constitution. Your attention is invited to Sec. 1 of Article IV of the Constitution, providing for the government of A.R.R.L. affairs by a Board of Directors; Sec. 2 of Article IV, defining their eligibility; and By-Laws, 14, 15, 16 and 17, providing for their nomination and election.

2. The election will take place during the month of November, 1928, on ballots which will be mailed from Headquarters in the first week of that month. The ballots for each Division will list the names of all eligible candidates nominated for the position by A.R.R.L. members residing in that Division.

3. Nominating petitions are hereby solicited. Ten or more A.R.R.L. members living in any Division have the privilege of nominating any member of the League in their Division as a candidate for Director. The following form for nomination is suggested:

(Place and date)

Executive Committee,
A.R.R.L. Headquarters,
Hartford, Conn.

Gentlemen:

We, the undersigned members of the A.R.R.L. residing in the ..... Division, hereby nominate ..... of ....., as a candidate for Director from this Division for 1929-1930.

(Signatures)

The signers must be League members in good standing. The nominee must be a League member in good standing and must be without commercial radio connections. His complete name and address should be given. All such petitions must be filed at the headquarters office of the League in Hartford, Conn., by noon of the first day of November, 1928. There is no limit on the number of petitions that may be filed, but no member shall append his signature to more than one such petition.

4. Present Directors from these Divisions are as follows: Central, Mr. Clyde E. Darr, Detroit; Hudson, Dr. Lawrence J. Dunn, Brooklyn; New England, Dr. Elliott A. White, Hanover, N.H.; Northwestern, Mr. Karl W. Weingarten, Tacoma; Roanoke, Mr. W. Tredway Gravely, Danville, Va.; Rocky Mountain, Mr. Paul M. Segal, Denver; West Gulf, Mr. Frank M. Corlett, Dallas.

5. This is your opportunity to put the man of your choice in office as the representative of your Division. Members are urged to take the initiative and file nominating petitions immediately.

For the Board of Directors:
K. B. WARNER, Secretary.
Hartford, Conn., 1 September, 1928.

Strays

Reports have been circulating in amateur radio that the UV-203-A 50-watt tube is no longer available. The rumor is untrue. The tube is still available, but must be ordered direct from the R.C.A. in New York. Only the UX-852 and the UX-210 are available from dealers. All the other transmitting tubes are sold under a sales agreement, through the Engineering Products Division, Radio Corporation of America, 233 Broadway, New York. Requests for information on, and orders for all transmitting and power rectifying tubes other than the 852 and the 210 should be addressed to that division.

edition.) This is one reason why coils wound with flat copper strip are so effective for high frequency work; there is not a lot of useless copper on the outside of each turn to cause eddy current losses.

This leads us to the right way to connect condensers in parallel. Put each condenser unit in a path of equal inductance. This is shown in Fig. 3 for various combinations. We have tried this out and know that it is worthwhile every time. With such arrangements, each condenser will carry its share of the load. Of course, each condenser in any parallel combination should be at least of the same rated capacity otherwise the difference in capacitive reactance thus formed will cause more current to flow through the larger capacities and might overload them. It might be well to point out here that the usual difficulty with condensers at these high frequencies is not voltage breakdown but heating and failure of the dielectric.

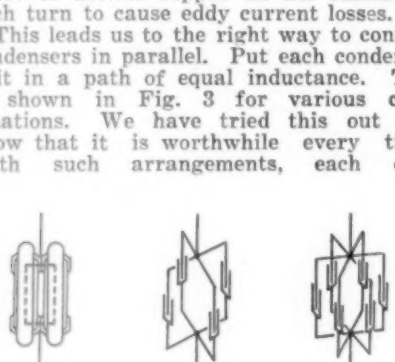


FIG. 3. HOW CONDENSERS SHOULD BE CONNECTED IN PARALLEL TO OBTAIN EQUAL DISTRIBUTION OF CURRENT THROUGH ALL THE UNITS

In Fig. 4 is shown detail dimensions of standard parts which have been found very useful here at the Laboratory. These parts provide for 4 units in parallel and by using the ring fittings shown, such parallel units can be readily arranged with 2 or more sections in series where needed to take care of high plate voltages, and the like. Fitting of similar construction are employed to mount six condensers in parallel.

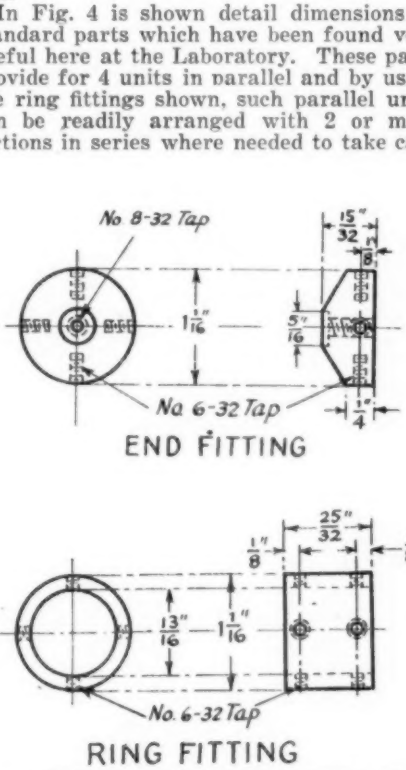


FIG. 4. DIMENSIONS OF THE MOUNTING UNITS TO CONNECT FOUR CONDENSERS IN PARALLEL

Connection to the rest of the circuit is made through 8 x 32 machine screws run into the threaded holes in the center of the end fittings. The ring fitting is employed to connect sets of four condensers in series. Several sets may be so connected making a solid mechanical as well as good electrical unit.

FOR THE 20-KW. TUBES

This group employs the same principles as do the smaller units although it has been necessary to change the mechanical arrangement somewhat. This unit has ten condensers in parallel with five sets in series. It is made up of 200 mufd. units which are built to stand a test voltage of 5,000 d.c. The total combination has a capacity of 400 mufds. and has been tested to 35 amperes at 18,000 kcs. It is only needed where 10- or 20-kw. water cooled tubes are being used.

It might be well to add a few words about choosing the proper kind of condenser units to use. One of the benefits to "Hamdom" from the coming of the BCL is the improvement in many radio parts available on the market. Among these are greatly improved small mica condensers. Originally intended mainly for use in receivers, it has been found that the better types, constructed of the best materials to rigid standards, are just the thing for use in high frequency transmitters. Notice that I did not say that all small mica condensers are good for transmitter work.

There are many makes of condensers on the market which are all right for use in receivers, but which will not stand up under the severe loads found in transmitters. The difficulty with most condensers of this type is that their internal losses are too high. Often this is true only when the condenser is passing appreciable currents which accounts for the fact that such condensers may be good low-loss units for receivers and yet fail in transmitter use.

A suggested set of rough specifications is given below. The units should be entirely enclosed to prevent accumulation of dust and moisture across and between the edges of the mica sheets. A complete water-tight enclosure is to be preferred since only a slight amount of moisture may cause a rapid rise in losses. Condensers should be capable of carrying the currents specified in the table below without exceeding an ultimate temperature rise of 10° C above surrounding temperature.

Capacity	R. F. amps. at 6000 Kcs.
.0002 to .00059 mfd.	3 amps.
.0006 to .00099 mfd.	4 amps.
.001 mfd. and larger	5 amps.

ELECTION NOTICES

To All A.R.R.L. Members Residing in the Central, Hudson, New England, Northwestern (including Territory of Alaska), Roanoke, Rocky Mountain and West Gulf Divisions:

1. You are hereby notified that an election for an A.R.R.L. Director, for the term 1929-1930, is about to be held in each of the above Divisions, in accordance with the Constitution. Your attention is invited to Sec. 1 of Article IV of the Constitution, providing for the government of A.R.R.L. affairs by a Board of Directors; Sec. 2 of Article IV, defining their eligibility; and By-Laws, 14, 15, 16 and 17, providing for their nomination and election.

2. The election will take place during the month of November, 1928, on ballots which will be mailed from Headquarters in the first week of that month. The ballots for each Division will list the names of all eligible candidates nominated for the position by A.R.R.L. members residing in that Division.

3. Nominating petitions are hereby solicited. Ten or more A.R.R.L. members living in any Division have the privilege of nominating any member of the League in their Division as a candidate for Director. The following form for nomination is suggested:

(Place and date)

Executive Committee,
A.R.R.L. Headquarters,
Hartford, Conn.

Gentlemen:

We, the undersigned members of the A.R.R.L. residing in the ..... Division, hereby nominate ..... of ....., as a candidate for Director from this Division for 1929-1930.

(Signatures)

The signers must be League members in good standing. The nominee must be a League member in good standing and must be without commercial radio connections. His complete name and address should be given. All such petitions must be filed at the headquarters office of the League in Hartford, Conn., by noon of the first day of November, 1928. There is no limit on the number of petitions that may be filed, but no member shall append his signature to more than one such petition.

4. Present Directors from these Divisions are as follows: Central, Mr. Clyde E. Darr, Detroit; Hudson, Dr. Lawrence J. Dunn, Brooklyn; New England, Dr. Elliott A. White, Hanover, N.H.; Northwestern, Mr. Karl W. Weingarten, Tacoma; Roanoke, Mr. W. Tredway Gravely, Danville, Va.; Rocky Mountain, Mr. Paul M. Segal, Denver; West Gulf, Mr. Frank M. Corlett, Dallas.

5. This is your opportunity to put the man of your choice in office as the representative of your Division. Members are urged to take the initiative and file nominating petitions immediately.

For the Board of Directors:
K. B. WARNER, Secretary.
Hartford, Conn., 1 September, 1928.

Strays

Reports have been circulating in amateur radio that the UV-203-A 50-watt tube is no longer available. The rumor is untrue. The tube is still available, but must be ordered direct from the R.C.A. in New York. Only the UX-852 and the UX-210 are available from dealers. All the other transmitting tubes are sold under a sales agreement, through the Engineering Products Division, Radio Corporation of America, 233 Broadway, New York. Requests for information on, and orders for all transmitting and power rectifying tubes other than the 852 and the 210 should be addressed to that division.

Conducted by A. L. Budlong

AS this report is being written, a number of replies have come in from Presidents of National Sections regarding the vote on the proposed new Constitution. It appears, so far, that the objections cited to the first proposal have been satisfactorily taken care of in the second proposal; we hope and believe that the new Constitution can be reported on as being adopted, in the next issue of *QST*. In addition to the *QST* notice, of course, more detailed written reports will be mailed promptly to all Section officers.

The editor of this department again wishes to urge upon the presidents and secretaries of all National Sections that they send in regularly each month some kind of a report for their respective sections. During the Summer it was to be expected that reports would fall off somewhat, but with the Fall approaching, there should begin a greater interest in amateur radio. See to it that your country is represented in this section of the magazine each month by sending in a short report to reach Union Headquarters not later than the 25th of each month.

Information is particularly requested from foreign countries regarding the attitude of their governments toward the new amateur wavebands. We want to know as soon as possible how much of these bands is going to be made available to you, what powers will be allowed, intermediates designated, etc. Please advise this office promptly when such information becomes definitely known.

ACTIVITY IN THE AZORES

In a letter to the I.A.R.U. editor, Mr. M. S. Killen, Hon. Sec'y. of the Western Union Radio Club, Horta, Fayal, Azores, states:

"Our club station, ep3MK, works on 45 meters, 80 watts input to a Hartley oscillator. Our club has just commenced working, but there is much interest, and we have already made contact with nu2UN and nu2NV. We want to let all NU stations know that we are anxious to QSO them."

BELGIUM

According to a letter from Mr. Paul de Neck, President of the Reseau Belge (Belgian I.A.R.U. Section) there has not been so much activity for the beginning of the summer due to the influx of a great many new members, all young in the noble art of transmitting, and a period of motoring, football, etc., on the part of the old-timers. His report, which follows, shows an encouraging amount of amateur work, however:

"eb4AU recently worked a Japanese unlicensed station on 20 meters, making the first EB-AJ contact. He also worked a Canadian ship anchored in Papeete harbor (Tahiti) and reports a QSO with VPG, a British station at Accra, on the Gold Coast of Africa.

"eb4FT, on regular schedule, worked a French ship bound for the West African coast practically every night up to the arrival of the ship at Port Gentil, in the Gabon, its port of destination.

"eb4AR is particularly interested in going after ships, and works lots of them.

"eb4OU, on 45 meters, puts out phone over the whole of Europe, with 100% readability, and recently received a report from Siberia commenting on the excellence of his phone quality. He is using a Belgian ham circuit, called the 'circuit Van Gasse', and with 45 watts input is one of the best phones in Europe.

"eb4FT has just informed us that he worked a new official short-wave station skVPC, on 32 meters. The QRA: Port Stanley, Falkland Islands.
—*Paul de Neck, President, Reseau Belge.*"

CHILE

nu5APG, K. M. Ehret, at Oklahoma City, reports a recent QSO with that well-known Chilean station sc2AS, in which the latter stated that he was starting a new business further south and would definitely be off the air with the old set for at least two years, there being no electricity available at the new location. 2AS stated, however,

(Continued on Page 62)

Calls Heard

Luis Greco Loprena, Calle Habana 7A, alta, Santiago de Cuba, Cuba

(Heard during June)

1aba 1acm 1acu 1acy 1agd 1arb 1as 1bbe 1bc 1bcr 1bbm 1cb 1cbg 1ch 1cmf 1cpi 1gw 1mx 1no 1qi 1rp 1tr 1vm 1vw 2alb 2apy 2arb 2bea 2bek 2bgg 2bgk 2bgq 2brx 2bsr 2bxr 2cf 2cv 2cxl 2dq 2kp 2la 2om 2pa 2pw 2rs 2tp 2ty 2ou 2xaf 2xc 2xs 3aep 3anh 3arx 3cc 3ccy 3eg 3sh 3ts 3ut 4aep 4aq 4abi 4ck 4dq 4fe 4ha 4rr 4ud 4wo 5aba 5acn 5aep 5aff 5ag 5aig 5ain 5api 5aq 5ar 5ary 5aw 5ayl 5cf 5ea 5en 5fi 5fl 5ky 5le 5lac 5oa 5si 6am 6auk 6bgp 6byq 6ba 6cy 6dcv 6di 6dqb 6oiv 6wyk 7adx 7ail 7alp 7awn 7fc 8af 8ap 8apn 8avd 8axq 8azg 8bhn 8bho 8bhq 8bhr 8bvx 8byw 8ccl 8ccq 8clq 8nx 8cug 8exc 8cxd 8djg 8dno 8ei 9bal 9bcq 9bo 9bq 9bsy 9bwj 9cev 9cif 9cue 9ex 9exc 9cys 9dce 9dkg 9ejw 9et 9evn 9fs 9iv 9pd nc-9dkg nj-2pa nq-2ac nq-2kp nq-4bn nq-5cx nq-5cq nq-5ry sa-8wb sc-2nb se-2om ue-3cs.

H. J. Conti, 15 Harbor Terrace Drive, Rye, N. Y.

nc-1ad nc-1ax nc-2bb nc-3aj nc-3ar nc-3ay nc-3bm nc-3cc nc-3in nc-3mv nc-9am nc-9cx velap velar velec veleo veldq ve2br ve3bo ve3br ve4cb ne-8ae ne-8rg nj-2pa nm-9a nm-xda nn-1nic nq-2cf nq-2iq nq-5by nq-5ea nq-5fc nq-5fl nr-2ea ns-1fmh ea-gp ea-jh en-ky eb-4fe ef-7ly ee-arc7 ef-8axq ef-8btr ef-8cl ef-8er ef-8gdb ef-8gyd ef-8lt ef-8pns ef-8rrm ef-8vu ef-8wb eg-2un eg-5dh eg-5lw eg-6bb eg-6by eg-6dp ei-1ee ei-1do ei-1mg ei-1mm ek-4abg en-oj2 ep-1ae ep-1ef ep-3am ep-3gb sb-1ah sb-1at sb-1bg sb-1ca sb-1id sb-2bz sc-2ah se-1mi se-2ea se-2jm su-1cg fe-suw fm-8gkc fq-pm oa-3jk od-afv oh-6ajl.

70V; Don Newman, RFD 12, Box 632, Seattle, Wash.

(20 meters)

1agr 1ap 1atr 1av 1aw 1bcr 1byl 1cki 1om 2ayj 2bc 2dk 2gr 2nj 2qv 3aqi 3ee 3gr 4nek 4am 4ck 4dt 4dv 4gg 4pd 5nek 5ahx 5akp 5aot 5ara 5ast 5at 5auz 5awp 5bbc 5bf 5bg 5bh 5bw 5em 5ie 5kj 5ql 5qo 5rg 5ta 5uk 5xd 5yb 5za 5zas 5zav 7aav 7abg 7acb 7aet 7aev 7afo 7afu 7aij 7ail 7aka 7akj 7alz 7uq 8akv 8avp 8awf 8axf 8azg 8bc 8box 8brh 8ccl 8cep 8cmx 8cpc 8dcd 8djv 8dma 8dne 8nb 8db 9acl 9aid 9ajw 9ama 9any 9asx 9atq 9avo 9axf 9bcx 9bez 9bjp 9bqy 9bxx 9byo 9bzy 9cet 9cjc 9crd 9csr 9cuh 9cvb 9cwa 9db 9dex 9dfy 9dgr 9dhp 9dih 9djs 9doq 9drd 9dvr 9dvu 9eag 9ecz 9efd 9efh 9eta 9euh 9exs 9eyl 9ez 9fbw 9fei 9fdt 9fhy 9gab 9gty 9hl 9na 9qy 9ux 9wk na-7ady na-7aer na-7mn na-7nr nc-2ca nc-4gg nc-4ha nc-5bn velaw ve2br ve8cs ve4gg nj-2pz eg-2ur eg-5by eg-5ma eg-5ml eg-5yq ef-8fc ef-8fd ef-8orm oa-2uk oa-2yi oa-3bd oa-3gr oa-3my oa-4bb oa-7lj oz-2ae oz-3aw oz-7mu oh-6alm oh-6avl oh-6clj oh-6dey oh-6dud oh-6eat sb-1aw sc-2ab sc-2as wnp voq.

E. J. Sahm, 265 E. 182nd St., New York City

(20 meters)

6bjh 6by 6bzs 6cgm 6ej 6csj 6czk 6xg 6xu 6zzd 7mx ee-ear91 ef-8fd eg-5by eg-6by eg-6yv ek-4abn fe-1es fe-egez oa-2ac oa-3bd oz-2bg.

(40 meters)

ek-4yt ep-1cn nc-2av nc-3ay nq-5cx nq-5fc nq-5fl sb-1ah sb-1id.

ei-1TU, Dante Balaffi, Torino, Italy.

1bgq 2ii 3sz 3eg nn-1na nq-5cx sb-1bg sb-1as sb-1bs sb-1ar sb-1ah sb-1aw sb-1ca sb-2ad sb-7ab sc-2ar su-1oa su-2ak oz-2ga oz-2am oz-2aq oz-3az oz-2bg oz-4am oz-2ae oz-3ar fm-8gk fm-8jo fm-8ev fm-8gat fm-8hpg fq-pm fq-Ocya ft-nft.

1BUX, D. H. Borden, Touisset, Mass.

(20 meters)

eb-4au ed-7zg xed-Oij ee-ear65 ee-ear70 ef-8bf ef-8btr ef-8dmf ef-8eo ef-8est ef-8fr ef-8hip ef-8hpu ef-8orm ef-8rrr ef-1m eg-2ay eg-2kf eg-2nh eg-2qv eg-2sc eg-2vq eg-5is eg-5ml eg-5uw eg-5vl eg-6bd eg-6dr eg-6hf eg-6hp eg-6ig eg-6mi eg-6oh eg-6rb eg-6ta eg-6vp eg-6wi eg-6wl eg-6wt eg-6xp eg-6yv ei-1dy ei-1gl ei-1gw ei-1po ek-4abg ek-4ka en-Owr ep-1aa ep-1bk fe-egez fk-4ms fm-tun2, fq-8hpg np-4agf np-4sa nq-2kp ny-1aa sa-fc6 sb-1ah sb-1aw sb-1ib sb-2ab sb-2az sc-2ah sc-2ar sc-3ac sc-3cj su-1bx su-1cx oa-2hm oa-2jk oa-2rc oa-2rx oa-2ss oa-2yi oa-3bq oa-3my oa-3xo oa-4nw oa-5bj oa-7cw oa-7lj oz-2ac oz-2ae.

(40 meters)

ea-jh eb-4di eb-4fp eb-4ro ee-ear94 ef-8btr ef-8zb ei-1go ek-4uai ef-4uj ek-4yt em-smua ep-1ae ep-1bl ep-1bx ep-1by ep-1cn ep-3am ep-3gb et-tpav fq-8hpg fq-ocya nj-2pa nm-9a nn-1nic nq-2ea nq-5ay nq-5by nq-5cx nq-5ea nq-5fl nq-pwal nr-2ags nr-2ea ns-4mwn oa-2bv oa-2ij oa-2kb oa-2rb oa-2wc oa-3bm oa-3bq oa-3jk oa-3pj oa-3wh oa-3xo oa-4pn oa-5dx oa-5hg oa-5if oa-5jh oa-5rj oa-5ws oa-7cw oa-7dx oa-7lj oa-7wt oz-2ga oa-3ar oz-3au oz-3az oz-4am sa-bx2 sa-ca2 sa-de3 sa-dl9 sa-dq4 sb-1ah sb-1ak sb-1aq sb-1ca sb-1cn sb-1id sb-2ad sb-2ah sb-2aj sb-2al sb-2bg sb-5ah sb-9af sc-2ab sc-cnag se-1em se-1mi se-2ah se-2jm so-1aa su-1fb su-1oa su-2ak.

Harold G. Fownes, 110 Riddiford St., Wellington, New Zealand.

1aal 1ayj 1anh 1cdx 1bub 1com 1aur 1asr 1bjp 1aoo 1bat 1zl 1nq 1akz 1aww 1um 1bzi 1ajm 1vh 1nk 1ue 1cam 1asu 1bkp 1bvl 1byv 1ry 1ajm 2bcb 2box 2kr 2alp 2bxg 2bbx 2ctq 2asb 2amd 2ie 2baz 2bir 2ate 2ahg 2agn 2at 2adl 2fc 2asz 2ass 2qu 2aol 2aha 2awa 2awx 2qu 2apa 2ahm 2ctf 3alq 3bbw 3bnu 3atp 3aed 3apx 3ade 3ag 3wj 3ajh 3cbx 3qp 3nf 3bnu 3aop 3ais 3cfx 3ku 3akb 3aei 3aoc 3cfg 3bgs 3avm na-7abz na-7mn na-7abe na-7aer na-7aam na-7to na-7hl nc-7ax nc-1ak nc-1ay nc-2ax nc-2bb nc-2bw nc-3cs nc-3dy nc-3el nc-3hp nc-3ni nc-3qn nc-3md nc-4aj nc-4fv nc-4gb nc-4hm nc-4gt nc-4ac nc-5ad nc-5al nc-5cj nc-5co nm-1aa nm-9a np-4aan np-3jg np-4kd np-4sa nh-ca nx-1xl ac-2cp nc-8to ac-8na ag-67ra aj-jxcx aq-1lm lq-imdz op-1ad oh-tdju oh-6ch oh-6dlr oh-6xk od-ipr sa-an8 sa-da8 sa-de8 sb-1aw sb-2aw sb-3qa fm-tun2 fo-a3c fo-a3z eb-4ax eb-4yz ed-7dd ef-8ix ef-8ct ef-8zf eg-5by eg-5hs eg-5yx eg-6rg eg-6ut eg-2cx ej-7dd en-Ogg ep-1bx ep-1bk ew-h2 ew-ab.

eg-5BZ, G. G. E. Bennett, 26 Blenheim Park Road, Croydon, Surrey, England

(During May—On 20 Meters)

1abd 1adm 1adw 1aff 1akm 1aqd 1aqt 1asf 1atr 1bcr 1bed 1big 1bil 1bux 1bvl 1bxe 1eab 1cjh 1cmz 1de 1fn 1kh 1mx 1si 1ue 1uo 1vw 1xaw 2ag 2agp 2ain 2arb 2awq 2azl 2bbx 2bcw 2bdr 2bfq 2bfy 2bjm 2bmk 2bms 2bot 2bxr 2cdm 2ch 2ck 2ctq 2ff 2ih 2sb 2sj 2vk 2xad 2xg 3aal 3aih 3ann 3anv 3aqj 3bgg 3bwj 3chk 3db 3dg 3di 3dr 3wm 3zf 4aay 4acc 4adb 4aek 4afc 4agr 4ck 4db 4dv 4io 4il 4nl 4ow 4pd 4pl 4kn 4ry 4to 4wm 5acl 5adn 5ae 5afk 5aq 5ara 5atj 5auz 5avs 5nyb 5azu 5bbc 5bj 5dq 5dv 5gf 5he 5kg 5mq 5ns 5oo 5rg 5wz 5zav 6agr 6ahs 6ajm 6alw 6ard 6azs 6bgv 6bjd 6bjh 6bkd 6boa 6bq 6bux 6bzf 6cdw 6cgm 6chq 6col 6cyx 6cze 6czz 6dbo 6ddy 6dep 6dev 6dfs 6dhq 6djk 6dlw 6dom 6don 6dor 6drb 6dri 6ec 6ih 6jg 6jn 6kb 6pw 6uf 6uz 6wb 6xi 6xu 6zzd 7aav 7acs 7acy 7aff 7afo 7aij 7akj 7ako 7ek 7fe 7fh 7kt 7lt 7md 7mv 7mx 7nr 7ov 7sf 7tj 7vq 8abh 8acm 8adg 8anv 8avp 8bbl 8bdp 8ben 8bev 8bg 8bkq 8byn 8cne 8ecl 8ecw 8clt 8cmb 8cnh 8cpd 8cwie 8dce 8dfw 8djv 8dqk 8gz 8jj 8kq 8nb 9abu 9aid 9ajw 9ake 9alz

(Continued on Page 72)

Correspondence

The Publishers of QST assume no responsibility for statements made herein by correspondents.

For Next Year

136 High St.,
Exeter, N. H.

Editor, *QST*:

What is to be done about it? Must the name of *QST* be changed after January 1st next? It is to be noted that "QST" is not included in the list of "Q" signals adopted by the Washington Convention and apparently "CQ" is to take its place (Article 9 bis, Par. 3). Won't the CQ hounds laugh if our magazine must be called "CQ".

Seriously, though, I hope that an article will soon be forthcoming dealing with the changes in operating procedure which must be made in accordance with the Convention. Much has been said about the new wavelengths, but very little about the other ways in which amateur operation will be affected. Of course most of the regulations apply to commercial work, but it would seem that, for the sake of uniformity, the amateurs should conform to them as far as possible.

For example, I don't suppose that the amateurs are bound to use the new set of audibility signals ("R" signals), running from 1 to 5, but it seems to me that they should do so, especially as I think that the new ones are better than the present ones running up to 9.

The new list of "Q" signals certainly looks different from the old one. It will take some time to get used to QRZ meaning "You are being called by—"; QRV "Send a series of V's"; QSR "The distress call received from—has been attended to by—"; etc. It is amusing to note, among the numerous miscellaneous abbreviations which have been authorized, that "OK" is officially recognized, meaning, "We are in agreement."

Probably the owners of amateur phones will have little occasion to send out SOS's, although perhaps some of them ought to do so, but they may wonder why the official radiophone distress call is "Mayday," until it is understood that this stands for the French "m'aider".

I am wondering if the amateurs will adopt "C" for Yes and "N" for No, or if such expressions as "Yep" will continue to hold their own. Do you think there would be any advantage in trying to establish a set of abbreviations especially suited to amateur use, just as the commercials have their "Z" signals? These might be special "Q's", although there would be a disadvantage i mixing the official with the unofficial. W already have "73," so how about extendi this plan? Thus, for example "71", migh mean "Please send card" etc *ad infinitu* A rather lengthly list might serve i emergencies, as for instance, when opera tors do not speak each other's language, h I am not enough of a DX man to spea with authority on such matters.

I am glad to see that national prefixe rather than intermediates, are to be use hereafter. I have never cared for the in termediate plan and I guess we have all ha the experience of listening to a long strin of calls, only to find that the all-importa intermediate was given carelessly or wa lost in QRM or QSS. The prefixes ought t go far towards making station identifica tion easier.

Into what class do amateur stations fall They are "fixed" in that they are "perma nently located and communicating with on or more stations similarly located," but i most ways their operation (except whe working on schedule) seems to be more o the nature of that of mobile stations, a referred to in the Convention. Probably thi is a matter of no importance, however.

I am sure that an article in *QST* on som of the points mentioned would be of interes to many of us.

—*H. S. Shaw, 1R*

The reader is referred to the Editorial pages of th issue.—Editor.

The "Splatter System"

[In which Dr. Hulburt, of Taylor and Hulbu fame, comments on the possibilities or impossibiliti of the "Warner Splatter System."—Editor.]

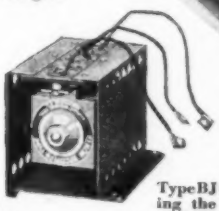
Naval Research Laboratory
Anacostia, D. C.

Editor, *QST*:

In *QST* for July 1928, page 7, I rea your captivating suggestion of the "Warne Splatter System" for the use of the 5 megacycle (10 meter) waves. This system based on Meissner's 80-degree angle lon distance experiment, contemplates directin these waves more or less vertically upwar with the idea that they be splashed dow from the skyward regions. From the de scriptions which I have read about the over head regions I wonder whether the wire

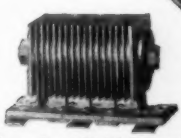
ELKON REPLACEMENT RECTIFIERS Are Saving Radio Fans MILLIONS of DOLLARS

Type BNK for replacing the acid jars in Balkite Types N and K Trickle chargers



Type BJ for replacing the acid jars in Balkite Type J chargers

Type V-4 for replacing the rectifiers in 6 makes of Trickle chargers



Type M-16 for replacing the rectifiers in 11 makes of "A" Eliminators and 3 Ampere chargers

Type EBH for replacing the BH type Tubes in "B" Eliminators

Millions of dollars are invested in radio chargers, eliminators, etc. which would be lost if it were not possible to replace the rectifying units when their life has been exhausted. All Elkon Rectifiers are replaceable.

HOW TO TELL IF YOUR RECTIFIER NEEDS REPLACING?

If your trickle charger no longer keeps your storage battery up the way it did when new, you need a new rectifier.

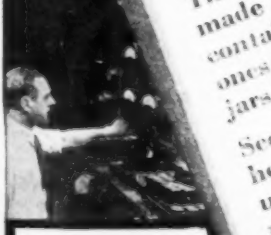
If your set has not the same pep as it did when you installed your "A" Eliminator, you need a new rectifier.

Do not void the Manufacturers' Guarantee on your Balkite Power Units

The Elkon Replacement Units and those made by the Fansteel Products Company containing an Elkon Rectifier, are the only ones authorized for replacement of the acid jars in Balkite Power Units.

See your dealer today—there are thousands of hours of good reception left in your power units as soon as you have replaced your rectifier or acid jar with a new dry Elkon.

ELKON, INC.
Port Chester, N.Y.
Division P. R. Mallory & Co., Inc.



Every Elkon Rectifier goes through these exacting tests.

ELKON, Inc., Radio Department
220 Fox Island Road, Port Chester, N. Y.
Please send me complete information on the Elkon Radio Products.

Name .....

Address .....

less waves will act as the system has suggested. To have any considerable splashing, or scattering, of the wave would require electron coagulations of rather high density—ten million or so per cubic centimeter (or a million, million ions)—whereas the usual electronic densities are probably a hundred times less. It is difficult to see any way in which such coagulations could occur under normal conditions, although they might possibly exist under unusual circumstances, as during wind storms in the high atmosphere, aurora displays, et cetera. On the whole, one cannot be quite certain yet of the meaning of Messner's experiment.

There is, however, a scattering of the 10-meter waves which unquestionably does exist—a scattering from the waves of the sea. Sea water has a very high refractive index for these waves (twice as high as the index of a diamond for light) and consequently is a very perfect reflector. It is like molten silver for light waves. If an observer had an eye sensitive to 10 meter waves and were situated aloft over a patch of the sea on which were falling a sheaf of the waves, he would see the water waves and ripples shimmering and scintillating very brilliantly in all directions with the 10-meter illumination. The same thing, but prehaps to a lesser extent, would be expected to be true of the facets and inequalities of the land. This type of scattering may be of importance in the 10-meter communication channels, such as filling in the skip zones, indicating storms at sea and the like.

—*E. O. Hulburt.*

Danger

[The following letter from S. C. M. Sears, to an amateur in Los Angeles, is published to bring this subject to the attention of the membership, so that all members may be warned against accepting such offers. The Los Angeles amateur stated that there would be "something in it for the stations doing this work." Amateurs cannot accept compensation for their services in handling messages. See the article by Mr. Segal on page 13 of July *QST*.—Editor.]

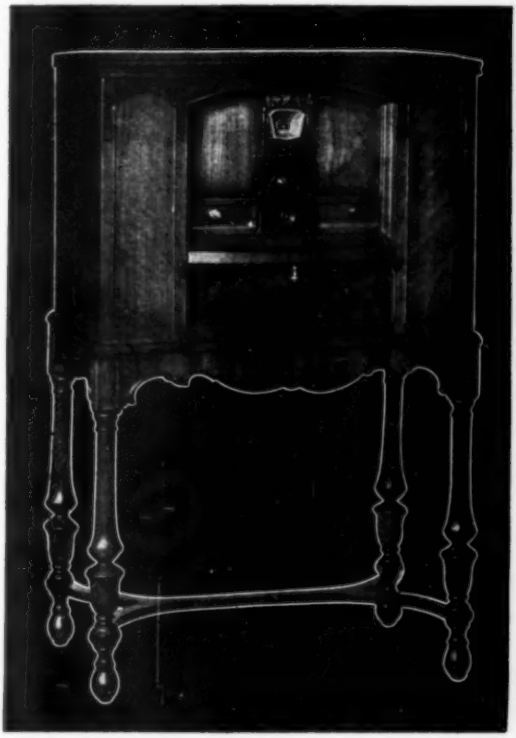
LaJolla, Calif.,
May 27, 1928.

Dear OM:

I am in receipt of your letter of the 25th with reference to lining up some San Diego amateur station to handle orders between the ..... Company, where you are employed, and the ..... Company of San Diego.

I am sorry, indeed, that I cannot do as you request. To handle such business, the stations involved would have to operate under a limited commercial license; such work not being permitted under an amateur license. Recently some of our stations have have had to decline similar messages from other sources, as they do not care to jeopardize their licenses.

NEW
Console Model
A. C. TUBE
Stromberg-Carlson



No. 636 Stromberg-Carlson Uses 5 UY-227 A.C., one UX-171 Output Tube, and one UX-280 RCA Tubes. Price, less Tubes and Speaker, $245. Slightly higher Rockies and West and Canada.

HERE is the wonderful Receiver you have dreamed of owning—a Receiver with the celebrated Stromberg-Carlson tone, at a price within the reach of everyone.

Not only the tone but its extreme sensitivity—its keen selectivity—its splendid workmanship tell you at once it is a Stromberg-Carlson.

This Receiver has a handy jack to facilitate playing records electrically through the wonderful audio system of the Receiver; thus making it possible to convert any standard phonograph into a high quality modern electrical reproducing instrument.

The beautiful cabinet sets a new standard in radio. It is low, artistically designed, with two-toned Walnut panels and top of matched Walnut butts. A slide which may be used as a writing table acts as a cover to close the front.

STROMBERG-CARLSON TELEPHONE MFG. CO., ROCHESTER, NEW YORK

The Stromberg-Carlson Sextette Friday Evenings at ten o'clock Eastern Daylight Time through the N B C and 22 Associated Stations

Stromberg-Carlson

MAKERS OF VOICE TRANSMISSION AND VOICE RECEPTION APPARATUS FOR MORE THAN 30 YEARS

I trust that you will understand my reasons for taking this stand, and hope that you will be able to effect some other arrangement that will prove satisfactory. The Boulevard Express Company maintain stations in Los Angeles and San Diego and might be in a position to help you out on this.

Yours very truly,

—G. A. Sears, Section Communications Chisholm eg2CX. Members A.R.R.L.

Why YL'S Become Amateurs

"Round Hills,"
So. Dartmouth, Mass.

Editor, *QST*:

I have been wondering if you and the other "hams" wouldn't be interested in hearing from a YL operator—since they seem to be rather scarce—and perhaps hearing how a YL became a "ham".

My husband, being the Radio Engineer for "The Round Hills Radio Corporation," had a transmitter and seemed to have such a lot of fun staying up all night operating it, that I began to think that I was missing a lot. So that—and the fact that I was afraid of becoming a "radio widow"—caused me to learn the code and become the YL operator at Station 1BHS.

I am not saying much about how the amateurs, whom I QSO'ed, had to suffer when I started (and I'm not so good yet) but I will say they were all perfectly great about sending slowly and repeating possibly a dozen times, and I would like to take this opportunity to thank them.

I wish some more YL's would get the "bug". I have attended two conventions; one in Boston and one in New York and only met two other YL operators. In Boston I was rather backward, but in New York I entered the contests with the rest and came back to Round Hills with four tubes and an aluminum shield.

—Helen Davis, YL at 1BHS.

In Appreciation

Aboard S.S. *Astoria*, in port,
Seattle, Washington.

Editor, *QST*:

Having just finished reading the excellent article by Mr. Boyden Sparkes in the *Saturday Evening Post* for July 21st, entitled "Some Attic Adventures," in which Mr. Sparkes has so ably caught the spirit of amateur radio and placed it before the public, it comes to me that we could show our appreciation of this in some way, such as by letters or station cards. The writer can recall no comprehensive article on this subject ever having been printed in the more popular non-radio magazines, and it seems that Mr. Sparkes is due a sincere vote of thanks from each of us. Many of our difficulties can be traced to lack of informa-

tion on the part of the public, and truthful publicity of this kind will certainly go a long way toward establishing a better understanding of the radio amateurs of the world.

—Emry C. Stuedle, 6NW, KGEP, 5503 South Cimarron, Los Angeles, Calif.

"es" and "&"

4338 W. Fort St.,
Detroit, Michigan.

Editor, *QST*:

Many of the fellows, in their correspondence and on QSL cards, write the abbreviated "and," "es" instead of "&". No doubt this is due to the general run of amateurs being unaware that ". . ." is the character for "&" in the American Morse code.

—J. O. Ellison, 8COW-8AGR.

"Propaganda Cards"

66 Ingram Road,
Thornton Heath,
Surrey, England.

Editor, *QST*:

Probably many American hams have by now received a card from a British station which bears at the head an inscription which can only be read as a direct insult to the R. S. G. B.

Although, so far as we have been able to find out, the operator's only objection to the R. S. G. B. is that it does not give the same value for the money as the A. R. R. L., he does not join up and lend a hand with improving things, but tries his hardest to discourage other intending members from joining.

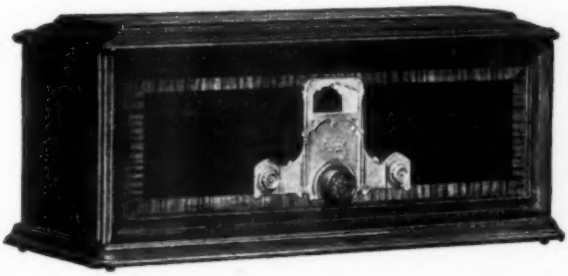
QST readers will realize that the T. & R. Bulletin, with its minute circulation as compared with *QST*, is neither so large nor so prolific in advertisements, but that it will grow if the R. S. G. B. is given support by the British hams, and not if they all cry off and do nothing whatever to support it.

Luckily there are not many such "hams" in Great Britain, but the existence of one or two is enough to cause anxiety to those who are looking forward to a British version of the A. R. R. L. as the ultimate outcome of the R. S. G. B., with a proportionate large membership.

We hope that stations seeing these propaganda cards will not treat them seriously, and will realize that they only express the sentiments of a very few unfortunates who have lost interest because they have been content to watch the work of others instead of doing their own bit.

—L. H. Thomas, eg6QB, D. W. Heightman, eg6DH, H. D. Price, eg6HP, H. Chisholm egBCX. Members A.R.R.L.

America's Most Sensational D.X. Receiver



IN planning the F 11, Federal had but one goal — to produce, regardless of cost, the most sensationally performing radio receiver that skilled engineers could devise. Delicate hair-line tuning, together with an almost unbelievable distance range, attests to their success.

Antenna and ground operation with four stages of tuned radio frequency coupled with detector, and two stages of amplification will bring in even the weakest of radio impulses picked up by the antenna. Each unit of the set including the individual tubes, is completely shielded. The chassis is of sturdy all-metal construction — the cabinet of genuine mahogany.

This set may be had either for battery or for light socket operation with Federal's power-tube coupler which greatly enhances tonal quality and the efficiency of the set.

Prices, without tubes, for battery operation, $250; for light socket operation, 60 cycle, $360; 25 cycle, $380. (Slightly higher west of Rockies.)

The designated Federal retailer in your community will gladly demonstrate this phenomenal receiver, or you may write direct for complete specifications.

Remarkable Federal Feats

A Federal F 11 at Buffalo, N.Y., has a record of verified reception from JOAK-Tokyo, Japan, 2LO-London, England, CWX-Havana, Cuba, and practically every distant station in this country.

FEDERAL RADIO CORPORATION, BUFFALO, N.Y.
OPERATING BROADCAST STATION WGR AT BUFFALO
Federal Ortho-sonic Radio, Ltd., Bridgeburg, Ont.

Federal Radio

ORTHO-SONIC*

Licensed under patents owned and or controlled by Radio Corporation of America, and in Canada by Canadian Radio Patents, Ltd.

** Federal's fundamental exclusive development making possible Ortho-sonic reproduction is patented under U.S. Letters Patent No. 1,588,470*

Award of Honor

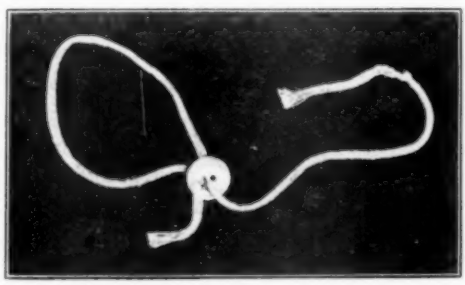
Anvik, Alaska,
May 14, 1928.

Mr. Kenneth B. Warner:

It has been noted here, in Alaska, that while many bouquets were handed you after the Conference in Washington, and a few bricks were thrown, none of those substantial rewards were tendered you which are ordinarily so gratifying to the recipient and which testify to posterity of the gratitude of his contemporaries. It is, therefore, with great pleasure that I have to inform you, that the Bunkodyne, which you will find enclosed, has been awarded to you.

The Bunkodyne, as you are probably aware, is to the A.R.R.L. amateur what the Carnegie Peace Prize is to the prize fighter and the Pulitzer Medal is to the pacifist, the *ne plus ultra* of recognition.

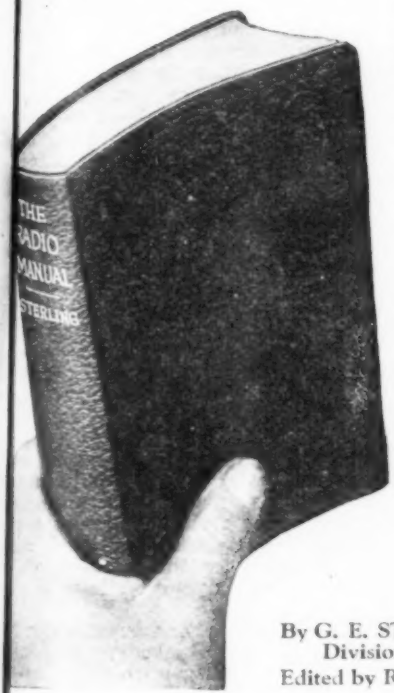
The latest award was made to Mr. Everett Lasher, of 7ADY, Latouche, Alaska, who makes a specialty of routing his "nu" correspondence via England. Mr. Lasher has constructed his transmitter in



such a way that it can be used as a long distance pulmotor. He recently revived a o who lost consciousness during a CQ endurance test. Mr. Lasher's want of judgment was overlooked in view of the humanitarian impulse which led him to do what would otherwise have been reprehensible. At the time that the award was made, I made the mistake of informing him that it was the 347th award that had been made during the present year. On looking up the record, I find that in point of fact, it was the second award that has been made since the foundation, in 1923. The first award was made to Mr. Charles A. Service, Jr., for being good looking. No other names were considered at the time. Your name, therefore, in point of time is the third on the list; but in point of honor, as one who loves his fellow ham, it leads all the rest. Please accept my congratulations.

The Bunkodyne, as you probably know, is a perfect substitute for the rubber bands and shawl straps which are principally responsible for the decline in morals which is characteristic of the present generation. It consists, essentially, of a grid, an inductance and a condenser. The condenser, which is the tightening or binding element, is in the form of a loop which is passed through

Radio Operators!



Are you prepared to use the new International "Q" signals which go into effect January 1, 1929? Do you know the correct procedure for obtaining a radio compass bearing as prescribed by the terms of the International Radio Telegraphic Convention, effective January 1, 1929?—the right procedure when distress communications are ended and silence is no longer necessary?—what to do when you hear from a radiotelephone station the spoken expression **Mayday?**

These Questions and Thousands More Are Answered In

THE RADIO MANUAL

A Complete Handbook of Principles, Methods, Apparatus for Students, Amateur and Comercial Operators, Inspectors

By G. E. STERLING, Radio Inspector and Examining Officer, Radio Division, U. S. Dept. of Commerce.
Edited by ROBERT S. KRUSE, for five years Technical Editor of QST.

Complete Preparation for Government License. 16 Chapters Covering

1. Elementary Electricity and Magnetism
2. Motors and Generators
3. Storage Batterics and Charging Circuits
4. Theory and Application of the Vacuum Tube
5. Fundamental Circuits Employed in Vacuum Tube Transmitters
6. Modulating Systems Employed in Radio Broadcasting
7. Wavemeters, Piezo-Electric Oscillators, Wave Traps and Field Strength Measuring Apparatus
8. Marine Vacuum Tube Transmitters including detailed description of Model ET-3626
9. Radio Broadcasting Equipment including, for the first time in any text book, the complete equipment of Western Electric 5 Kilowatt broadcasting Transmitter used in over 75% of American broadcasting stations.
10. Arc Transmitters including description of Federal Marine 2 Kilowatt Arc Transmitter Type AM 4151; also models "K" and "Q"
11. Spark Transmitters including description of Navy Standard 2 Kilowatt Transmitter
12. Commercial Radio Receivers and Associated Apparatus including, for first time in any text book description and circuit dingram of Western Electric Superheterodyne Receiver Type 6004C
13. Marine and Aircraft Radio Beacons and Direction Finders.
14. The Development of Amateur Short Wave Apparatus. Complete details of construction, operation and licenses.
15. Radio Laws and Regulations of the U. S. and International Radio Telegraph Convention. Quotations of all important sections
16. Handling and Abstracting Traffic

Examine It Free

Special Price Now

"The Radio Manual" is now on the press and will be ready shortly. Over 900 pages bound in flexible Fabrikoid. Regular price after publication will be $6.00. Orders received now will be accepted at the special advance price of $4.95. Send no money now. Examine the book first. Pay or return in ten days.

Order On This Coupon

D. VAN NOSTRAND CO., INC., 8 Warren St., N. Y.

Send me as soon as published THE RADIO MANUAL for examination. Within ten days after receipt I will either return the volume or send you $4.95.—The special advance price.

Name .....
(QST 9-28)
St. and Number .....
City and State .....

one of the two holes which form the grid, the other being reserved to receive the condenser in the event of the first hole being worn out. The grid is located in the middle of the inductance. The inductance and grid may be purchased from any mail order house or any dealer in second hand buttonholes. The condenser consists of a string of any desirable length, having a resistance one inch more or less, from each end. The ends beyond the resistance are the filaments. One of these, F, is longer than the other, f. In operation, the letters, papers, million-dollar bills, etc. which it is desired to keep together having been placed in the loop of the condenser, the filament F is pulled steadily and firmly until the desired degree of compression has been attained. It will be found that it will release this compression, if it is desired to extract one or more of the papers or the bills. A gentle pull will effect this.

The Bunkodyne is a patented device. The award carries with it the privilege of manufacture and sale; subject, of course, to prosecution by the holders of the patent rights. It is not known who they are; but it can, doubtless, be found out by experiment.

In making the Bunkodyne award, it is customary to send with it case remittance of $342,671.00, or as much of this amount as may be available from the interest accumulations on the original foundation investment of $00.29; but in this instance, out of a delicate regard for your feelings, this feature is omitted.

Trusting that you will find great enjoyment in the use of the Bunkodyne and in the exercise of the privileges which accompany the award,

I am sincerely yours,
John W. Chapman, na7TE.

P. S. Having discharged the responsible duties which have devolved upon me, I want to say that it would be a good thing for your critics to ponder upon what would have happened to us if you had *not* taken part in the conference at Washington.

I. A. R. U. News

(Continued from Page 50)

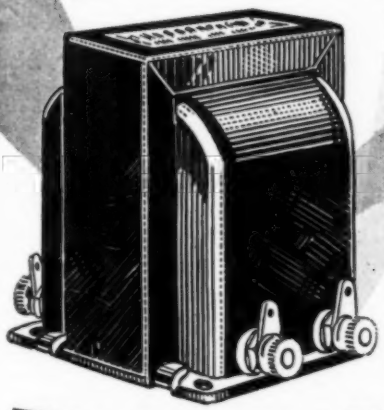
that he would try to set up a transmitter with a 201A tube and a dry-cell plate supply.

We are sorry to see the old 2AS go off the air, but hope that some satisfactory QSO's are established with the baby set in the new location. Let us hear from you by mail, at least, OM.

CHINA

Father E. Gherzi, S.J., in charge of the weather and seismic services at the Meteorological Observatory at Zi-ka-wei, near Shanghai, and already familiar to *QST* readers from his article on fading in the June issue, writes as follows:

A NEW NOTE IN AUDIO AMPLIFICATION



THORDARSON R-300 AUDIO TRANSFORMER

SUPREME in musical performance, the new Thordarson R-300 Audio Transformer brings a greater realism to radio reproduction. Introducing a new core material, "DX-Metal" (a product of the Thordarson Laboratory), the amplification range has been extended still further into the lower register, so that even the deepest tones now may be reproduced with amazing fidelity.

The amplification curve of this transformer is practically a straight line from 30 cycles to 8,000 cycles. A high frequency cut-off is provided at 8,000 cycles to confine the amplification to useful frequencies only, and to eliminate undesirable scratch that may reach the audio transformer.

When you hear the R-300 you will appreciate the popularity of Thordarson transformers among the leading receiving set manufacturers. The R-300 retails for $8.00.

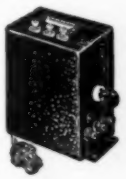
Power Supply Transformers

These transformers supply full wave rectifiers using two UX-281 tubes, for power amplifiers using either 210 or 250 types power amplifying tubes as follows: T-2098 for two 210 power tubes, $20.00; T-2900 for single 250 power tube, $20.00; T-2950 for two 250 tubes, $29.50.

Double Choke Units

Consist of two 30 henry chokes in one case. T-2099 for use with power supply transformer T-2098, $14; T-3099 for use with transformer T-2900, $16; T-3100 for use with transformer T-2950, $18.

Power Compacts



A very efficient and compact form of power supply unit. Power transformer and filter chokes all in one case. Type R-171 for Raytheon rectifier and 171 type power tube, $15.00; Type R-210 for UX-281 rectifier and 210 power tube, $20.00; Type R-280 for UX-280 rectifier and 171 power tube, $17.00.

Speaker Coupling Transformers

A complete line of transformers to couple either single or push-pull 171, 210 or 250 power tubes into either high impedance or dynamic speakers. Prices from $6.00 to $12.00.

Screen Grid Audio Coupler

The Thordarson Z-Coupler T-2909 is a special impedance unit designed to couple a screen grid tube in the audio amplifier into a power tube. Produces excellent base note reproduction and amplification vastly in excess of ordinary systems. Price, $12.00.

THORDARSON ELECTRIC MFG. CO.
500 W. Huron St., Chicago, Ill. 3583-F

Gentlemen: Please send me your constructional booklets on your power amplifiers. I am especially interested in amplifiers using.....tubes.

Name.....

Street and No......

Town..... *State*.....

THORDARSON ELECTRIC MANUFACTURING CO.
Transformer Specialists Since 1895
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
Huron and Kingsbury Streets — Chicago, Ill. U.S.A.

"I think amateurs everywhere might be interested in knowing that I am sending every day at 0145, 0945, and 1215 GCT, on 23 meters, a weather bulletin giving meteorological observations from many stations in the Far East. As this sending is always done with the same power—220 watts—at a very exact hour, I would be indeed grateful to all hams who could try to listen in. The transmissions last about 15 minutes.

"I am sure that various official weather bureaus, for instance, along the Pacific Coast, would be glad to get these observations, and it would be another feather in the cap of the amateur if through this channel a scientific link could be established between the observatories on each side of the Pacific Ocean.

"The station is always operated by myself, QRH 23 meters, under the call ac8ZW. The note is fairly distinctive, being 500 cycles."

ENGLAND

May: "Most work during May has been done on 23 meters but conditions do not seem to have been as good as usual; at any rate, in the latter half of the month. 5ML's best QSO's were with the sixth and seventh US districts and the third, fourth and fifth Canadian and with OA, SC, SB, AI and fk2MS. Lately he has been listening on ten meters without hearing much so far. 2XV had consistent contact with the sixth and seventh with 75 watts until the middle of the month, when he too found conditions fall off. OA and OZ were also worked on 23, and a number of these boys seem to have left their old pet 30 meters for the lower band. Some interesting QSO's were had with nu1II and 2XV is looking forward to meeting him in person soon.

"5YK worked fk2MS and the usual sixes and sevens on 23; he has been trying phone on this wave, too, and also did some work with negative results on the 10-meter band. 5YX, who like 5YK is crystal controlled, worked two NU sevens and some fives on 32 meters during March and would like to know if any six heard him as he could not raise one. 5BQ is getting out FB on 23 and wants schedules with the NU fourth and NC. What offers, gang?

"2CB and 2CX are working South America on 23, but 2CB cannot seem to get decent contact with the States. He is one of the 'mangle brigade' using a hand generator for power supply. 6QB has worked heaps of sixth and seventh district stations, getting R6 from both on 23 meters with low power. He also hooked OA and nc4FB. 2NH ran a schedule with oz4AM for 39 days without a break! He is also investigating ten meters. 6BB works AS and SU on 45 meters as well as the U.S.A. 6PA has worked all over the States on 23 with a power unit of five watts. Good work, OM.

"6HP works OA on 23 but has difficulty with South America. 6CL has had some

interesting NU contacts early in the month but like everyone else is finding things dud just now. 5HS is very QRW but will be QRV again soon.

"The Third Annual Convention of the R.S.G.B. is to take place on the 28th and 29th of September, and any American hams over here on these dates will be welcomed. Further details as to programme are not yet available, but it is sure to be wonderful for everyone."

—*K. E. Brian Jay, eg2HJ.*

"*June:* The general impression this month is that the pet 23-metre band has been bad—at any rate, compared with previous months. It would seem by comparison with last year that this state of affairs will last until about next February, as far as super-DX is concerned.

"5YK worked NU fourth on phone and got R4 with 60 watts crystal. He could not raise either the sixth district or the Antipodes, both of which were weak. He is working on a ten-metre crystal set, employing a new principle. This station will be ready to go on 10.15 metres as soon as the license arrives.

"5YX has done nothing, being QRW with exams . 5BY has been going strong, however. 2XV found conditions rather poor, but in spite of this worked su2BT, sb2AJ, sb2AX and a few NU stations; also oa2RB on 32 metres, the others being on 23. Frequent QSO's were had with nu1II to make various arrangements about his visit to England. 2XV will shortly be on the 8-to 10-metre band and reports will be welcome; the word TEN will be sent after each transmission to show it is not a harmonic. Operations will probably commence early in August.

"Other hams busy on ten metres are 2NH and 6QB, who also are to be found on 23 and 90. 2CX worked SB and SC, so is now WAC. Very FB OM. 2AX worked lots of NU's and SC and AQ on 23. 6WN cannot raise NU, so would welcome reports on his signals if any one hears them. 6CL on 23 was called by an NU four, but did not hear him. 6PA says NU is only local when conditions are good. 2CB worked OA, SC and NU first, on 23, but has difficulties with the States; he, too, would like reports.

"6RB worked the world on 23 in May, but has not had any luck in June.

"Many hams are rebuilding and getting set for next year, and 5YK's standard frequency transmissions are being found of the greatest value. 6QB with his standard R.S.G.B. wavemeter is pretty busy, too. Most of the British members are now preparing for the new Washington wavelengths, which may become effective any day now.

—*K. E. Brian Jay, eg2HJ.*

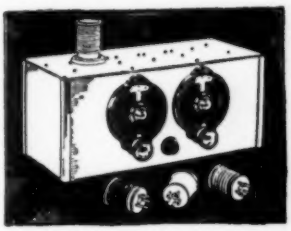
FRANCE

From a letter sent in by our old friend Leon Deloy, one of the past presidents of

SM "ROUND THE WORLD" FOUR

Just What the Name Implies!

The trimmest short wave set ever—that's the verdict everywhere on the new 730 S-M "Round-the-World" Four. It does everything you expect of a short-wave receiver—everything, even, that you expect of an S-M receiver. The Radio Broadcast Laboratory, in initial tests of the 730, received English 5SW daily on the speaker, during afternoon hours. 9BBW, receiving on the "Round-the World" Four, worked in one evening stations in Germany, France, England and Italy. Low-power amateur code stations over the U. S. and Canada are received regularly on the 730. And for television work, it's ideal!



New S-M 131 Plug-In Coils (used in the 730) wound on moulded bakelite, fit any 5-prong tube sockets. Wound, $1.25, or blank, $0.50 each.

The "Round-the-World" Four is a complete four-tube regenerative, non-radiating short wave receiver kit with aluminum shielding cabinet. It has one screen grid r.f. stage, a regenerative, non-radiating detector, and two high-gain Clough audio stages. It tunes from 17.4 to 204 meters with four plug-in coils. The kit is $51.00, complete with cabinet, four coils, and full instructions—ready for immediate shipment.

The 731 "Round the World" Adapter is the two-tube, r.f. amplifier and detector, less the two stage a.f. amplifier of the above set. With an adapter plug, it converts any set to long-distance short wave reception. Price, complete with cabinet and four coils (17.4 to 204 meters) $36.00. The 732 "Round the World" Essential Kit contains the two tuning and tickler condensers, the four plug-in coils, coil socket, and three r.f. chokes, with full instructions for building a one, two, three or four tube short wave set. It costs but $16.50 complete.

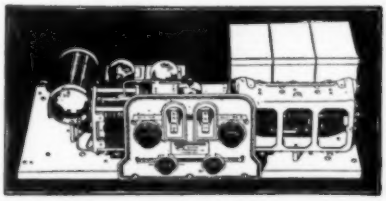
And it beats anything for getting out into the short-wave "Thrill Band." Choose the kit you prefer—and "step out!"

720 Screen Grid Six

The Year's Biggest Value

This is the set that S-M gets squarely behind and tells you it's the biggest value in broadcast-band receivers to be found today. A man-sized recommendation!

Successor to the famous Shielded Grid Six that took the country by storm, the 720 is the kind of a set you can build in an evening, on its pierced metal chassis. When it's finished and you put it on the air—then the real surprise begins. Distant stations will come in, one after another, with local



volume, and positive 10 kc. selectivity. As to tone, the 720's superiority is insured by the new 255 and 256 audios, as described at the right.

Look at the 720's features as you see them in the picture, and remember that S-M backs it to the limit—assures you that you can't get more actual radio elsewhere at twice the cost. Then note the prices: Custom-built complete in a beautiful two-tone brown metal shielding cabinet, $102.00. Complete kit only $72.50, with the same cabinet $9.25 additional.

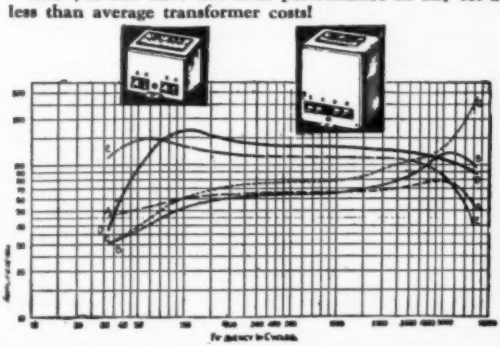
Better order now—such values spell scarcity!

Audio Transformers

Just Two Years in Advance

Radically new in principle, these transformers are the first to give freedom from the hysteretic distortion found in all other types. They combine decided advances in both tone and volume, as will be seen below. E is the two-stage curve for the large size transformers (S-M 225, 1st stage, and 226, 2d stage, $9.00 each); D is that of the smaller ones (S-M 255 and 256, $6.00 each). Note the marked advantage over A, B, and C—all standard eight and ten dollar transformers under equal conditions.

And you can have this finer performance in any set at less than average transformer costs!



The S-M catalog describes all these products, as well as A and B Power Supplies, Power Amplifiers, Modulation Transformers, etc.

Are you receiving the "The Radiobuilder" regularly? Every month it gives you all the earliest S-M news, operating hints and kinks. To S-M Authorized Service Stations, it comes free of charge, with all new constructional Data Sheets. If you build professionally, write us about the Service Station franchises.

SILVER-MARSHALL, Inc., 858 W. JACKSON BLVD. CHICAGO, - - U. S. A.

Silver-Marshall, Inc.
858 W. Jackson Blvd., Chicago, U. S. A.

....Send your complete catalog, with sample copy of the Radiobuilder.

....For enclosed 10c, send five sample S-M Data Sheets.

Name.....

Address.....

the R.E.F. (Reseau Emetteurs Francais) we learn that in a recent election a new president was appointed to this society, and is Mr. Reyt, Professor au Lycee, 24 Rue des Vaupulents, Orleans (Loiret) France. Mr. Reyt, who is well-known to all amateurs through his calls 8FD and 8YOR, was elected in May; Pierre Louis and Mr. Deloy become Honorary Presidents.

We extend our sincere congratulations to Mr. Reyt on his new appointment.

GERMANY

A card from ek4HX, contains this interesting information:

"I beg you to put a few lines in *QST* about QSL's for EK. Many NU amateurs send cards direct, but that is dangerous for us, and the cards often do not reach their destination. All cards for EK stations should be sent via DFTV, Berlin W57, Blumenthalstr. 19. Perhaps NU OM's don't know that all EK stations with a '4' and only *two* letters in the call-sign are unlicensed."

Remodeling the Traffic Tower

(Continued from Page 42)

depends upon the position of the band on the dial To cover 500 kcs. starting at 3500 kcs. requires a dial rotation of from 134 to 18 degrees or 116 degrees. Now, if we start at 3350 kcs. or 147 degrees, we have to rotate the condenser only 72 degrees to get to 3850 kcs. Thus if we cut our coils so as to place the desired range at the lower dial readings, the maximum dial rotation will be obtained for a given band. Of course, at the lower range of the condenser, any changes in circuit capacity will have a larger effect upon calibration than at the higher capacity settings. With this in view and the thought that the minimum capacity across the coil due to the tube socket, wiring, etc., may vary to some extent in other receivers, no effort was made to squeeze the last dial division out of the ranges. He who is so inclined may do this; others will perhaps be satisfied with the ranges as they are. At any rate, it requires but little effort to add or subtract one turn, more or less, and you can suit yourself.

Well! So far we have a pretty decent 1928 affair but it isn't much of a world-beater for the 1929 conditions. By doing some more adjusting and shifting, we can make it into just as good a 1929 set as it is a 1928 one.

The shunt adjustable condenser can be dropped because there will be but five bands in all—and the smaller section of the tuning condenser will be employed for tuning on the 7000- and 14000-kc. bands while the two sections in parallel will be used for the 1750-, 3500- and 28000-kc. bands. Of course, they will both have to be reduced in capacity.

New AC electric receivers replace old radio models

Replace Your Old Radio!

radios at any price line ALL the following ures which are so neces- to the fine radio re- you may have to- Crosley gives you ALL at the world's st prices.

NEUTRODYNE AMPLIFICATION

Crosley Radios tune efficiently
Crosley neutrodyne ceiver is sharp, sensi- and selective.

Crosley Radios are shielded
element is shielded each other. This creases the efficiency of set. Stations close gether are easily sep- ated.

Crosley Radios are selective
ore stations are packed together you will appreciate the selective qualities of Crosley radio. You listen to ONE station at a time.

Crosley Radios have volume
The volume of Cros- ley Radios is phe- nomenal for the small amount of bat- tery or AC current consumed. The vol- ume may be in- creased tremendously without distortion.

Crosley Radios can be softened to a whisper
The volume con- trol of Crosley sets is so positive that the operator may tune any broadcast station down to a whisper and scarcely lose reception.

Crosley Radios fit any kind of furniture
Console cases of Crosley radios are easily re- moved for instal- lation into any type of console cabinet.

Genuine 6 tube Neutrodyne Crosley GEMBOX $65

Self-contained A C electric receiver. Utilizes two radio, detector, two power and a rectifier tube (171 power output tube). Operates from 110 volt 60 cycle A C home lighting current.

Try this amazing set. Prove to yourself on a 5 DAY FREE TRIAL IN YOUR OWN HOME that no radio that approximates Crosley price can compare in performance. Why pay higher price?

This wonderful little Gembox is designed to use the new and astounding dynamic.

DYNACONE

the Crosley power speaker, which is radio's greatest development this year. A genuine dynamic speaker selling for $25 equals ANY in pure realistic tone—unmatchable in price.

5 tube dry cell operated BANDBOX Jr. $35.

Ideal set where recharging of storage battery is inconvenient

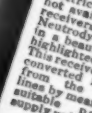
CROSLEY AC Electric Radio Sets unequalled values

Crosley A C Electric Radios operate on 25 to 40 and 60 cycles. Where A C 110 volt current is available they are perfect radio receivers. No better performance is obtainable. Cabinets can be built at any price to make radio expensive, but for realistic, powerful reception Crosley receivers know no superior.

8 tube A C Electric JEWELBOX $95
Genuine neutrodyne—3 stages radio amplification — 227 detector tube — 3 stages audio frequency (last two stages 171 push-pull power tubes) and 280 rectifier. Shielded coils, modern illuminated dial. Highly selective.

8 tube AC Electric SHOWBOX $80
Genuine neutrodyne 3 stages radio amplification, detector, 3 stages audio (last two being 171 push-pull power tubes) and 280 rectifier.

The 6 tube BANDBOX battery type $55
The Bandbox is the radio for places where electric current is not available for AC receivers. Genuine Neutrodyne, housed in a beautiful grid highlighted case. This receiver can be converted for use from the power lines by means of a suitable power supply unit.



Improved Musicone $15
This Crosley achievement is the world's greatest success in the field of magnetic type speakers.

FREE TRIAL

Ask any Crosley dealer to hitch a new Crosley radio to your antenna. Test, try and prove in your own home (under the exact conditions you will enjoy your radio) the superior performance of Crosley sets. If you can't locate a nearby dealer, fill out the coupon below.

CROSLEY RADIO

The Crosley Radio Corporation
Cincinnati, Ohio
Powel Crosley, Jr., President

Montana, Wyoming, Colorado, New Mexico and West prices slightly higher.

Crosley Radio prices do not include tubes.

Mail this

COUPON

Dept. 18
I cannot locate a Crosley dealer. Please arrange for FREE 5 DAY TRIAL in my own home of the Crosley Radio I have checked.

Gembox ( ) Jewelbox ( )
Showbox ( ) Bandbox ( )
Bandbox Jr. ( ) Dynacone ( )
Musicone ( )

Name .....
Address .....

The distance between the plates in the smaller section should be increased until the 7000-kc. band is covered by a dial rotation of somewhat over 100 degrees. The spacing will be roughly equivalent to the thickness of 20 *QST* pages. In the other section, we can no longer use the capacity obtained by a single stator plate between two rotors and must shift the stator so that it is exposed to but one rotor plate. In this respect it will be similar to the smaller section although the spacing between the two plates will be less (about 10 *QST* pages).

We then get the following coil sizes and ranges:

Band in kcs.	Coil Range	Turns Sec	Tickler	Degrees For Band	Sections of Condtnser
1715-2000	1675-2055	77.	9	98	Both
3500-4000	3279-4000	37.	6	120	Both
7000-7300	6666-7316	26.25	5	118	Smaller
14000-14400	13045-14460	9.25	4	60	Smaller
28000-30000	27900-30800	2.75	3	45	Both

The types of winding, size of wire, spacing of turns, etc., are the same for these coils as for the previously described ones. The same coils may be used with the necessary turns added or removed as the case may demand.

Radio Set Tester

batteries or socket power devices. The various ranges are 600, 300, 60 and 8 volts and a resistance of 1,000 ohms per volt is had for all of them. Direct current ranges of 150 and 30 milliamperes are available for checking the plate current of the tubes as well as the output of various of the commonly used rectifiers.

For sets employing tubes similar to the UX-226 and UY-227, there is an a.c. voltmeter having ranges of 150, 8 and 4 volts. The four-volt range is used for checking the filament voltage for the tubes mentioned above, the eight-volt range will be convenient for ascertaining the voltage across the filaments of 171s, 210s and the various rectifier tubes now in use, while the highest range may be used to determine the line voltage which may vary considerably in some parts of the country.

It is possible to make measurements upon a tube under normal operating conditions employing for such tests the regular power supply to the set. It is also possible by means of a switch provided for that purpose to change the bias on the grid of a tube and by measurements of plate current to ascertain whether the tube is in good condition. A rotating switch is so arranged that measurements of the plate and filament voltage, plate current, bias, etcetera may be made in succession without moving any of the equipment excepting the switch.

A product of the Weston Electrical Instrument Corp. of Newark, N. J., this instrument is known as their Model 537, Radio Set Tester.

—*H. P. W.*

Calls Heard

(Continued from Page 51)

9anz 9ara 9asx 9avu 9axf 9aze 9bgn 9bgq 9bmx 9bqy 9bwk 9cfr 9che 9cok 9crd 9csr 9cuh 9cvd 9dk 9dkc 9dmt 9dng 9ecl 9ef 9egy 9ehd 9eoh 9esh 9eyq 9ez 9fci 9fbw 9pdj 9few 9fly 9fnz 9hm 9mt af-kol ai-2kt aj-jll am-3ab fe-2vo fe-sux fk-4ms fm-8ags fm-8ev fm-8jo fm-8rit fo-a3a na-7ady na-7aer na-7mn nc-cf nc-cq nc-1ar nc-2be nc-2ca nc-3ap nc-3cj nc-3cs nc-3fc nc-4dq nc-4fv nc-4ha nc-4hh nc-5au nc-5bn nm-27a np-wgt np-4agf np-4sa nq-2kp oa-2dy oa-2ij oa-2jy oa-2rc oa-2sh oa-2uk oa-2yi oa-3bd oa-3gr oa-3jj oa-3jk oa-3lp oa-3my oa-3vp oa-3xo oa-4lj oa-5bj oa-5bw oa-5by oa-5cm oa-5dx oa-5hg oa-5wh oa-7ch oa-7ew oa-vip oa-vis od-and od-anf oh-6alm oh-6avl oh-6bqj oh-6dey oh-6dki oh-6dud oh-6dvg oh-npm oz-1ao oz-2ae oz-2bg oz-2bx oz-3at oz-3aw oz-3ax oz-4ae oz-4am sb-sqi sb-1aw sb-1ib sc-3ac sc-3cj sl-hjg s.-hjo.

(On 40 Meters.)

1agg 1agw 1ajc 1akk 1anx 1anz 1aqi 1art 1asy 1axq 1bat 1bdm 1bed 1bki 1bia 1boe 1cft 1cjx 1cmf 1cmz 1cxj 1gw 1hb 1ic 1kb 1km 1lt 1mk 1mr 1nq 1si 1vt 1xh 2ace 2adl 2afa 2afw 2agw 2ajb 2amh 2ans 2apl 2apv 2aql 2ase 2avz 2axk 2ayk 2az 2azo 2bcy 2bda 2bdh 2bek 2bgb 2bgg 2bgq 2bgz 2bhv 2bih 2blc 2bov 2bsc 2btb 2bts 2btt 2bxr 2cdm 2chu 2cot 2cqd 2cwm 2cxl 2cyx 2dn 2dp 2dq 2fs 2gh 2gq 2ja 2je 2kl 2kr 2lx 2mb 2ps 2qc 2rk 2sj 2uo 2vc 2vd 2wi 2xd 3aac 3aaj 3acn 3aef 3ael 3afl 3afw 3afx 3age 3aib 3ajt 3amw 3anh 3aob 3ard 3arh 3arx 3ath 3atn 3ato 3aua 3auj 3auv 3auw 3bce 3bel 3bgz 3blp 3bn 3bns 3cbt 3cfg 3cjn 3dh 3ec 3er 3ez 3gb 3gr 3kd 3mb 3qt 3sz 3vg 4aba 4abz 4ac 4acv 4ada 4adf 4ado 4aec 4aeg 4aek 4aem 4aed 4afc 4agd 4aw 4ay 4cj 4ck 4dt 4ec 4ei 4ft 4gl 4gy 4hk 4ib 4ie 4iq 4jo 4jw 4kv 4ky 4lj 4oo 4ox 4px 4rn 4rr we 5afx 5agz 5ain 5aja 5apo 5arc 5as 5ats 5axn 5ayl 5bg 5gr 5he 5ie 5ih 5jc 5jy 5kh 5mx 5oc 5ql 5uk 5vh 5vx 5yb 5yw 6chk 6dww 6eah 6ju 6xb 7ek 8aau 8adu 8agu 8ahu 8ajj 8ame 8apn 8aty 8avz 8aw 8axg 8axz 8baz 8bbj 8bbs 8bi 8bky 8bjx 8bpa 8brh 8buj 8bva 8bvy 8bwn 8bwr 8cau 8cbd 8ees 8cfb 8chc 8chz 8clq 8cmf 8cmo 8cng 8cpc 8cq 8cof 8css 8cxc 8czr 8dal 8dad 8dbs 8ddu 8dfd 8dhx 8dsa 8dps 8dqi 8dra 8drg 8hc 8nt 8qb 8qh 8td 8tn 8uj 9aee 9aeo 9agb 9aju 9ake 9aou 9asb 9awt 9axu 9baz 9bga 9bre 9bsh 9bwo 9cia 9eis 9ekc 9enc 9eos 9eph 9esr 9eue 9euv 9evn 9eya 9db 9dbi 9dga 9ds 9efz 9ell 9elp 9eqp 9eru 9etd 9etv 9eul 9exr 9ezu 9feg 9fgp 9fkz 9fs 9lx 9ml 9ng 9nr 9sx 9xi naa nar nixb wcc wiz woo wuo oa-2bb oa-2dy oa-2lm oa-2rc oa-2yj oa-3gt oa-7lj oa-vim oz-2aq oz-2bg oz-2ga oz-3aj oz-3ar oz-3au oz-3cg oz-4ae oz-4am fe-2vo fe-sux nc-cf nc-2ea nc-3dz nc-3zb ne-8ae xnh-2vq nm-9a nm-xcsi nn-1nic nq-2cf nq-2iq nq-2sc nq-5fl nq-5uz nr-2ags nr-2ea xnu-6clv ny-1aa nz-fo5 sa-lp sb-poaa sb-3qa sb-9aa sc-cnag sc-2ab sl-cos sq-2g.

8AVS, Donald F. Byram, 43 River St., Homer, N. Y.

(20 Meters)

eb-4au ef-8eo ef-8et eg-5ml eg-5uw eg-5vl eg-6hp eg-5sk eg-6ut eg-6qb eg-6ht eg-6vp ei-lfp em-smuv em-smzf gi-2by gw-17c nr-cto.

(40 Meters)

eb-4wx eb-4ro ef-8gyd ef-8fc ef-8lx ef-8rbv ef-8hpg ef-8er ef-8orm ef-8xd ef-8ix ef-8est ef-8btr ef-8fxf eg-6rm eg-2nn ep-1bx fm-8rit fm-8ags fq-pm en-osf oa-3ls oa-3ep oz-3az oz-4am oh-6adh oh-6dey nm-1z nm-9a nm-8a nn-1nic nq-2ac nq-5cx nr-2ags na-1fmh sb-1aw se-2ah.

eg-6WY, H. Almaxwell Whyte, Burtleigh, Church Road, Forest Hill, S.E.

1di 1auk 1gx 1beb 1bat 1blf 1bz 1caw 1bke 1asu 1cjh 1ue 2blx 2aoj 2cjd 2afx 2bcw 2bha 2mg 2axx 2eaq 3di 4fs 4adb 8axa 8auc 8btr 8drj 9dbj 9asd 9ef.

8DDK, Hosea Decker, Delaware, Ohio

(Heard from April 18 to May 16)

oa-2dy oa-4ab oa-4nw oa-4lj oz-4ag fq-ocya eb-4au eb-4fp ef-8est ef-8fc ef-8hpg ef-8lx ef-8wb ei-1dy se-2ah sb-1aw sb-1id sb-2ag sb-2ak ne-8rg nm-1rz nm-9a nq-2jt nq-5ea nq-5cx nq-5fl nr-2ags nidk.

ef-8XD.

1aac 1abd 1abt 1abv 1adm 1aff 1age 1aha 1alb 1alr 1als 1amu 1apv 1aqp 1aqt 1avk 1auz 1axq 1bbe 1bed 1bft 1bke 1bjx 1bu 1bux 1cjh 1cmp 1cmx 1cpe 1cki 1jaa 1nq 1oh 1om 1mx 2aca 2adl 2aeb 2aco 2afw 2ahh 2aib 2afb 2akj 2ajg 2api 2ass 2atq 2atx 2awb 2aul 2avw

THE AMATEUR'S BOOKSHELF

Readers of *QST* appreciate the need for good radio books. What we consider to be the best standard text books are handled by A. R. R. L. Headquarters for the convenience of members of the league and readers of *QST*. Those listed below pretty well cover the requirements of the average amateur or experimenter.

The Radio Amateur's Handbook, by F. E. Handy, Communications Manager, A.R.R.L. Third edition. The standard text book and manual for transmitting amateurs. Contains immense quantity of data and information valuable to experimenters and all interested in any phase of radio. 256 pages, 297 illustrations **$1.00**

The Radio Amateur's Handbook, Cloth Bound Edition. Except for binding, identical with regular edition **2.00**

Radio Telephony For Amateurs, by Stuart Ballantine. One of the most valuable books we know of for the amateur. Theory, construction, practice. *Not* particularly about telephony. Heartily recommended for every amateur. 296 pp., 5½x8¼ **2.00**

Manual of Radio Telegraphy and Telephony, by Commander (now Admiral) S. S. Robison, U. S. N., published by the Naval Institute. "Ranks with the very best of all published radio matter . . . Not only worth its cost but is perhaps the best radio book that ever came to this desk."—*QST* Book Review. 895 pp., 6¾x10 ..... **4.00**

Experimental Radio, by Prof. R.R. Ramsey. Third Edition. A splendid manual for the student and experimenter describing in detail 117 experiments of particular value and interest to the amateur desiring a complete understanding of radio work. **2.75**

Principles of Radio Communication, by Prof. J. H. Morecroft. An elaborate general textbook. 935 pp., 5¾x9 ..... **7.50**

Radio Engineering Principles, by Lauer & Brown. An excellent general textbook **3.50**

Practical Radio Telegraphy, by Nilson & Hornung. 380 pages, 223 illustrations. A text for prospective commercial radio operators **3.00**

Wireless Pictures and Television, by T. Thorne Baker. 188 pages, 99 illustrations. Completely and clearly presents the whole subject **2.50**

Thermionic Vacuum Tube, by H. J. Van der Bijl **5.00**

Radio Frequency Measurements, by Moulin **10.00**

Prepared Radio Measurements, by R. R. Batcher **2.00**

Elements of Radio Communication, by Ellery W. Stone **3.00**

Radio Simplifier, by Kendell & Koehler, revised by J. M. Clayton **1.00**

Ideas For The Radio Experimenter's Laboratory, by M. B. Sleeper ... **.25**

Prices include postage

Read 'em and learn!

AMERICAN RADIO RELAY LEAGUE, INC.

1711 Park Street - - - - Hartford, Conn.

2az 2bad 2bav 2bbe 2bec 2bck 2ber 2bdf 2bfg 2bg 2bgg 2bjg 2bif 2bsc 2bke 2cin 2com 2crb 2cuq 2cx 2cyx 2fg 2ge 2hr 2dg 2nm 2rs 2up 2tt 2sz 2wi 2z 3aa 3aee 3afj 3aih 3anh 3ajh 3aqi 3aqm 3apm 3as 3aqz 3aso 3bip 3cfg 3cjn 3dh 3lz 3qw 3qe 4aby 4ac 4ac 4aef 4aej 4aep 4aek 4fl 4ds 4br 4cj 4cq 4ge 4m 4km 4me 4th 4tk 4td 4wc 5acl 5atf 5ayl 5rg 5v 5yb 8adg 8ary 8aw 8axa 8awu 8baz 8bbs 8bfw 8b 8baf 8bjb & hz 8bqr 8bou 8bto 8ceg 8clp 8cnh 8cz 8cpr 8ctl 8d4l 8dnf 8dod 8dsy 8gz 9ain 9ama 9bz 9cia 9crd 9cue 9cad 9ef 9erh 9ejo 9cex 9ccz 9fg 9tm nc-1ad nc-1by nc-1br nc-1rr nc-2be nm-1rz nn 9a nq-2ac n2-2cf nq-2kp nq-2ig nq-2ro nq-5ea nq-5a nq-5by nq-5cx nq-5fc nq-5fl nq-7ex ns-1fmh nu fr5.

ecRP19, Al Weirauch, Mestec Kralsve

1awe 1by 1ckp 2cxl 3sz nq-5fl sa-de3 sb-1ah sb-1at sb-1ar sb-1aq sb-1aw sb-1bo sb-1ca sb-1cg sb-1id sb-2ac sb-2ad sb-2af sb-2ay sb-7ab sc-1ah sc-1ai sc-2ah

(20 Meters)

1ads 1aff 1ry 2arb sc-3ac.

eu-78RA, W. Nelepez, USSR, Leningrad 2 27 Sagorodny pr log 13

1bt 1mf 1om 2cuq sb-2ad sb-2ay sc-2as sf-1dy fe-gn fe-1es fm-8ssr xed-7ach xed-7rl.

S.S. DROMORE CASTLE, New York City to Cape Town, South Africa, via 2CUF.
Operator Clyde Townsend, care the Union-Castle Mail Steamship Co., 26 Broadway, New York City.
Port Elizabeth to 5000 miles S. E. N. Y.

1aa 1aba 1awq 1aun 1bgq 1ckp 1no 1nq 1rp 1ut 2apd 2aqr 2atk 2atx 2aub 2axt 2bda 2bhr 2bke 2chb 2cuz 2cxl 2cxr 2ja 2kl 2kp 2mu 2ty 3aef 3api 3ard 3bmc 3qe 3py 3au 3avk 4abz 4acv 4ob 4tk 4ut 4vh 4wc 5ayl 5uc 6avl 6awa 6ccw 6ue 7awa 7ek 8awu 8bbs 8bhz 8bto 8byw 8ccw 8chi 8cxt 8dal 8eq 8xas 9bhg 9bwo 9eaj 9ecx 9eln 9erm 9fbv 9fhy 9ra afk arbm as-rao3 bye byb byz ea-1h eb-4co eb-4di eb-4ft ee-ear28 ef-8ev ef-8fd ef-8fx ef-8nox ef-80rm ef-8vvd ef-8wb ei-1fp en-ofp ep-1aa ep-1ae et-pju ew-hb fk-3ms fl fo-2srb fo-a3c fo-a3t fo-a3u fo-a4e fo-a4o fo-a4v fo-a5l fo-a5o fo-a5t fo-6sra fo-a7b fo-a7d fo-a7g fo-a7n fo-a7q fo-a8j fo-a9a fo-a9l fo-a9n fq-8hpg fq-ocya fq-pm gbj gbr gfa gjzt gkt gll ido isf kfu kzet lgn ocdj od-3bk oh-6avl oh-6dty ohk oxz ozc pch pcpp pdt pkh por rli rpo rza sb-1ad sb-1aq sb-1bt sb-1aw sb-1bo sb-1ca sb-1cm sb-1id sb-1no sb-2ad sb-3qa sb-5bf sb-7ab sfv sof soh swmk wnbt wuaq wva vkef vtc.

5000 to 4000 Miles S. E. N. Y.

1aoi 1bki 1ckp 1gw 1ro 1rp 1om 2apd 2aub 2avb 2bdf 2bhr 2bts 2cuz 2ev 2iq 2sm 2sm 3avk 3bbw 3bnu 3sj 3vg 4aba 4abg 4hy 4nc 4vp 5ayl 5sz 8acz 8axd 8axz 8bbs 8bky 8brh 8bvy 8chg 8cgk 8cmo 8cyg 8dps 8drj 8fhy 8gz 8li 8sx 9anl 9cev 9cnr 9fgs byb byw ee-ear28 ef-8wb ek-4abm ep-3am fo-a3z fo-a5t fq-ocya fq-pm gbr gfa gkt ido lgn naa ocdj pch rza sb-1ah sb-1aj sb-1bg sb-1cj sb-1cm sb-1id sb-2ad sb-2ah sb-2aj sb-2ar sb-2ba sb-5aa sb-7ab su-1oa snu sof sqbx spp wiz wnbt.

4000 to 3000 Miles S. E. N. Y.

1abt 1ade 1age 1ajd 1alb 1amf 1anz 1au 1avf 1eng 1cnz 1ga 1ic 1jm 1kh 1kr 1lx 1mx 1pu 1rp 2afa 2apd 2aql 2aqw 2auo 2baz 2bda 2bfn 2bhr 2bkk 2buy 2byw 2cot 2kx 2tw 2ty 2uo 2vi 2za 3aa 3aaj 3aeo 2afj 3afx 3am 3aqm 3arx 3aui 3auv 3cs 3ee 3nn 3nr 3qe 3sz 4acc 4acx 4ar 4at 4uq 4vh 4wm 5abi 5aux 5awd 5ayd 5ayl 5bt 5fo 5kg 6lv 8apn 8awu 8bbt 8bdt 8bkh 8bky 8chg 8chz 8cnt 8cpd 8cu 8eq 9afi 9ak 9api 9bir 9ceb 0dku 9dmt 9dlj 9eln 9erh 9fhm 9fnz agb agj byb byc eb-4di ed-7rl ee-ear65 ee-ear 28 ef-8fj ef-8pam eg-6kd ep-1ae ep-1bx ep-1ms ep-3am ep-1aa fq-8hpg gbr gkt gzc hjo nc-4fv nkf ozc pcpp pjd ptt sa-en8 sa-a2z sb-1aa sb-1ah sb-1aj sb-1an sb-1ar sb-1aw sb-1bg sb-1bt sb-1ca sb-1cb sb-1cj sb-1cn sb-1id sb-1tl sb-2ag sb-2aj sb-2bf sb-3qa sb-5aa sb-5bf sb-7ab sc-2aa su-1fc shln snn spw spx sqcl sqpa wgt wik wiz wqo wvr.

3000 to 2000 Miles S. E. N. Y.

1adb 1afd 1any 1asu 1axl 1bcb 1bqt 1cio 1ckp 1cnz 1no 1 nu 1vt 2ail 2amt 2ans 2aqd 2ass 2aup 2awq 2bav 2bda 2bif 2bit 2bkk 2bts 2bxr 2byw 2ch 2cxl 2dr 2kl 2mb 2qu 2sm 2vc 2wi 3ahh 3anh 3aob 3av 3bj 3dl 3ff 3sz 3sn 3wm 4acd 4acn 4aep 4ec 5gr 6aal 8agk 8akc 8akv 8ank 8bjb 8bpa 8btr 8cnt 8cnz 8cyg 8dds 8dfb 8dhc 8dnf 8dps 8dpw 8sx 8uj 8xl 9csb 9ef 9elb 9fax 9my 9uu byz ea-jh eb-4bu eb-4di ee-ear28 ef-8aa ef-8ajf ef-8btr ef-8ed ef-8fiz ef-8hpg ef-8il ef-8lx ef-8orm ef-8rrr ef-8wb eg-5ma eg-5vl ei-1as ei-1bs ei-1dy ep-1aa ep-1bv ep-1bz ep-3am ep-3gb fl-1ab fo-a5l fq-ocya gbo gbr gkt hjo kav

kfzq naa np-4ug nq-2cf ocdj olq perr pts sb-1
sb-1aw sb-1ca sb-1id sb-2ah sb-2bf sb-9aa sb-ptr
wik wiz wnbt.

2000 to 1000 Miles S. E. N. Y.

1agg 1alp 1bcb 1cgn 1ckp 1ga 1no 1nq 1qb
2apd 2ats 2avq 2ayj 2az 2bbe 2bda 2bgz 2bhr
2bjh 2bps 2bw 2ccw 2cdm 2crh 2cxl 2ja 2je
2ps 2vc 2vy 3aal 3afw 3afx 3agb 3ais 3ajh
3bno 3cjw 3dh 3di 3ds 3uz 3vg 4acv 4acz 4aec
4acv 4cj 4ea 4si 4ug 5acl 5ain 5awd 5ayl 6ear
8agy 8ajt 8ank 8apn 8axz 8bdf 8bhz 8bkt 8brf
8chp 8ciy 8cmo 8cnt 8cnz 8css 8dhc 8dsy 8li
9bhz 9cos 9ctg 9fax 9fgp 9gq 9kb 9gb 9gj 9yy
ee-ear28 ef-8btr ef-8wb eg-6nx es-2nak ep-3am
gbr gkt naa nc-2bb nm-lf nm-8a ocdj ohk pch
sb-1id sb-3bf wik wiz wll wnbt wsbs.

Cedric Serle, 1 Torrington St., Canterbury, Victoria Australia

(20 meters)

1adm 1aep 1asf 1asu 1awe 1cki 1cmx 1fl 1ry
1sz 2afx 2ags 2amn 2atx 2awf 2baa 2bcw 2bev
2bum 2cuq 2cuz 2gf 2np 2tp 2wc 2xad 3aib 3ani
3cm 3hf 3ly 4dt 4io 4km 4ll 4nh 4ob 4px 4to
5afb 5awd 5bf 5kg 5mx 5wz 5yb 5zav 6alm
6awp 6azs 6bau 6bax 6bgv 6bq 6by 6cby 6clt
6csj 6cvy 6dan 6dbo 6dcv 6dor 6doa 6jg 6vz
7fh 7si 8ane 8avp 8axa 8baf 8box 8btj 8bto 8cjm
8dbp 8dhx 8djv 8jq 8xe 9ckp 9dbj 9dku 9drd
9eq 9ez 9sd nc-3cs nc-3fc np-4sa ef-8fd ep-1ae
eg-2hh eg-2xv eg-5by eg-5ma eg-5ml eg-5mq
ei-1gw ai-2kx ai-2kt as-ra03 gi-6mu.

(40 meters)

1axa 1ay 1az 1bgq 1bhs 1mx 1wl 1zg 2alu
2cvj 2cxl 2ib 3sm 4fu 4lk 4oc 4u 4si 5ahx
5aqy 5auz 5bj 5kc 5ql 5we 5rg 6agr 6akw 6alz
6aov 6avy 6awa 6bag 6bcn 6bhv 6blp 6bpc 6bzn
6cgm 6cht 6cut 6dam 6dca 6dhg 6dju 6ea 6ec
7aax 7iz 8abw 8ahc 8axz 8bq 8dhs 8gz 8pa
8sh 8zg 9aok 9ara 9arn 9asc 9bev 9bxb 9cau
9cix 9ck 9ckf 9ckp 9cmz 9cya 9dg 9dfz 9dga
9dng 9enp 9ez 9rp 9xi nc-5co eb-4ar eb-4ft
nc-9bz sc-2as sc-2ax ac-1ax ac-2ck ac-2al ac-2fi
ac-2ff ac-8na ac-8rj ac-9aa fe-egez fe-ze oo-1aj
ef-8fc ef-8fd ef-8xd ef-8cp ef-8orm ef-8wb
oh-6adh oh-6alm oh-6avl oh-6boe oh-6bud
oh-6bqe oh-6bhl ch-6dtg oh-6xk ai-2bg aq-1lm
ei-1fb ei-1fp aj-1sk aj-1sm aj-2by aj-3bq aj-4bk
aj-4zz od-1jr od-2aj od-3bk od-4as od-6kl
am-3ab en-0rz en-0fp op-1bd op-1gz op-1cm
op-1rc ae-1hh as-35ra as-ra03 fo-a3q fo-a7l
oo-bam su-2bt su-1oa xnu-6dhg ardi na-wuj.

eg-2BOQ, H. E. Bottle, 27 Stormont Rd., London S. W. 5, England

(Heard during June 1928)

1abx 1aep 1afd 1aff 1afl 1aqd 1aqt 1asf 1awe
1bux 1bvl 1cmx 1fs 1ia 1jr 1kmp 1mr 1mx 1naa
1ry 1sx 1vw 2acj 2acn 2ahf 2aks 2arb 2arx 2ate
2bcg 2bfq 2bkk 2bme 2bmk 2chd 2cxl 2fu 2mb
3adm 3aqi 3bq 4aft 4lk 8agq 8agy 8awg 8baz
8cnh 8cqo 8cuq 8dgl 8duw 9cz sa-fc6 sb-1aw
sb-2ab sb-2at sb-2al sb-2ax sb-2az sc-2ah
sc-3cj su-1cx su-1na fe-egez fe-gm fe-les fm-tu
nc-1ad nc-2be.

eg-6YL, Miss B. Dunn, Stock, Essex, England

(40 meters)

(Heard during June 1928)

1ack 2ber 2bhr 2box 2cs 2va 8cla 8dgs nb-be3 ne-8
xed-7sch el-1ala el-1ai3 el-1als el-1a2b el-1a2g xel-a
em-sbm em-skb ep-1afc ep-1bv ep-1ca ep-1cn ep-1
xep-1ms eu-4rb eu-9rb eu-19rb eu-26ra eu-08ra
27ra eu-54ra eu-57ra eu-63ra eu-90ra eu-93ra eu-1
eu-oskw ag-67ra ar-8fbh sa-de3 sb-1ah sb-2az.

Book Reviews

By Harold P. Westman, Technical Editor

Practical Television by E. T. Larner with a foreword by John L. Baird, 175 pages, 9 figures and illustrations published by D Van Nostrand Company, Inc., New York City, New York. Price $3.75.

This book is apparently intended for general public consumption in that it treats the subject in that fashion commonly referred to as "popular". It give

a brief history of some of the many systems that have been devised for television, pointing out the principal manner in which they differ from each other. The more important difficulties confronting the experimenter and some of the methods evolved for their solution are also discussed. Elementary explanations of seleneum and photo-electric cells as well as of the cathode ray tube are given. A generous portion of the book has been devoted to the methods of Baird including descriptions of his "Noctovisor" and "Phonovisor". Picture transmission is treated but incidently, the author devoting practically all his space to television, that is, seeing at a distance. It is an interesting book through which the uninitiated may make his acquaintance with the subject in a not too technical manner.

Bible Dramas by William Ford Manley, 225 pages, published by Fleming H. Revell Company of New York City, New York.

There is but slight or no connection in the minds of most between radio and the Bible. It might, therefore, not be amiss to say that the reason for this review is that this series of **Bible Dramas** is published by arrangement with the National Broadcasting Company and covers a dozen stories prepared in such a manner as to make them suitable for radio presentation as well as for church or theatrical use.

The material has been so prepared that each story is complete in itself and although written primarily for radio presentation, makes interesting reading. It seems almost foolish to speak further concerning these when it is possible to get a vastly better and more accurate impression by listening in to one of the Bible Dramas as broadcast on Sunday nights over the N. B. C. Network of stations.

Storage Batteries Simplified by Victor W. Page, new revised edition, 258 pages, 112 figures, published by the Norman W. Henley Publishing Company of New York City, New York. Price $2.00.

This book is not an advanced work on storage batteries but rather, a simplified version as the title suggests. It is apparently aimed at the garage man whose knowledge of electrical equipment and theory is meagre and whose radio knowledge is a negative quantity. The author has drawn profusely upon the installation and operating instructions supplied by various storage battery manufacturers. It should have but little appeal to the radio man and perhaps the second sentence in this paragraph goes further towards describing the book than do all the rest.

Standard Time Conversion Chart.

Perhaps many remember the "Time Slide Rule" described on page 42 of the September, 1927 issue of *QST*. This chart is very similar, though in somewhat more detail. The circle indicating geographical locations is divided up to show every 7.5 degrees and the names of the principal countries through which these meridians pass is given. The time is shown from midnight to noon to midnight with the hours running from 1 to 12 rather than from 1 to 24. This may cause some inconvenience but is easily corrected and so should not be very damaging. It is called, Miscellaneous Publication No. 84 and may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. for 10 cents. No stamps or uncertified checks are accepted.

Conversion chart. (Kilocycles to meters or vice-versa.)

At this time when we are endeavoring to think and speak in kilocycles rather than meters, it is of utmost importance that we have some means of making this conversion with the least amount of effort. The Radio Division of the Department of Commerce, under whose jurisdiction the amateur is, are using the factor of 300,000 kilocycles per second in their conversions and this value will accordingly be used by *QST*. The Radio Division has had charts prepared covering values of from 10 to 29,990 in steps of 10 (the units may be either meters or kilocycles) and these may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. for 5 cents each. No stamps or uncertified checks are accepted.

Financial Statement

BY order of the Board of Directors the following statement of the income and disbursements of the American Radio Relay League for the second quarter of 1928 is published for the information of the membership.

K. B. WARNER, Secretary.

STATEMENT OF REVENUE AND EXPENSES FOR THE THREE MONTHS ENDED JUNE 30, 1928.

REVENUE

Advertising sales, *QST*		$ 14,810.09	
Newsdealer sales, *QST*		9,906.36	
Handbook sales		3,464.26	
Handbook advertising sales		1,305.00	
Dues and subscriptions		7,949.40	
Back numbers, etc.		889.29	
Emblems		146.85	
Interest earned		392.35	
Cash discount earned		318.66	
			$ 39,182.26
Deduct:			
Returns and allowances	$4,309.27		
Less portion charged to reserve for newsstand returns	1,306.51	3,002.76	
Discount 2% for cash		272.74	
Exchange and collection charges		16.45	3,291.95
Net Revenue			35,890.31

EXPENSES

Publication expenses *QST*	11,124.47	
Publication expenses, Handbook	1,521.99	
Salaries	14,056.25	
Forwarding expenses	565.24	
Telegraph, telephone and postage	1,066.91	
Office supplies and general expenses	1,660.93	
Rent, light and heat	927.50	
Traveling expenses	1,728.72	
Depreciation of furniture and equipment	493.56	
Bad debts written off	62.14	
Communications Dept. field expenses	71.30	
Total Expenses		33,279.01
Net Gain from Operations		$ 2,611.30

Indiana Central Division Convention

YES Sir! The Hoosier boys know how to run conventions and the Indianapolis Radio Club, who sponsored this year's affair which was held on July 28-29, more than kept up the reputation.

Beginning early Saturday morning delegates began arriving from different parts of the state and the register showed several from neighboring states. The forenoon was spent in getting acquainted and by the time the afternoon session was ready to open every one was on a friendly basis. Promptly at 2 o'clock, Director Darr called the convention to order and welcomed the guests. Then followed some really good informative addresses by F. R. Finehout, 9CLO, on crystal grinding and with practical demonstration. D. J. Angus, the SCM, 9CYQ, understands crystal circuits

and showed the gang what he could do with that small xtal-control portable set. H. F. Weakley of the Esterline-Angus Co. gave a good talk on Radio Instruments. C. E. Dutton of the A. T. & T. gave us a new angle on chain broadcasting and made us realize the advance which has been made in that particular field of radio. The most interesting lecture of the two-day sessions was that given by R. J. Kryter of the Presto-Lite- Battery Co. The subject of Rectifiers and Filters was handled in a masterly way. A. A. Hebert, Treasurer-Fieldman, from A.R.R.L. Headquarters, discussed the 1929 problems with which we amateurs will be faced, and told us what was being done by Headquarters to help relieve the situation.

Former Division Manager R. H. G. Mathews, Lt-Commander, U.S.N.R., brought a naval personnel with him, and enrolled 22 of the delegates present into the Naval Reserve. Matty is certainly a worker and if he continues the same pace he will have the best Unit in the service.

When we speak of Banquets we always think of those night affairs which are scheduled for 7 o'clock in the evening and let every one starve until 8 o'clock, but this banquet was another departure from the conventional—it was held in the afternoon; a real Sunday afternoon dinner.

There were so many nice things that took place that space prevents mentioning everything, but we will say that the good prizes donated by the manufacturers had to be won. The closing of the affair took place shortly after the dinner but not before OM Burns had had a chance to regale us with his entertainers—they were good too—and we now know he has an eye for pulchritude.

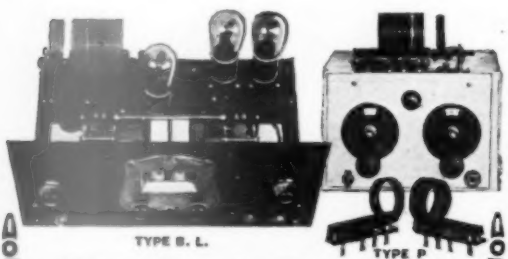
—*A. A. H.*

The New England Division Convention

Held at Augusta, Maine.

THE Maine A.R.R.L. Convention held at Augusta, July 13 and 14 was acclaimed by those who attended the biggest and best affair of the kind ever held in the Section. The Convention Committee secured the full coöperation of many state and local agencies in "putting it over". Chairman L.A. Burleigh Jr. (1KE), Secretary Fred Best (1BIG) and Leslie Hall were responsible for the fine arrangements. For those who drove from all parts of New England and New York large banners and signs pointed the way to Ham Headquarters at the Augusta Y.M.C.A. and bid the delegates welcome.

The opening sessions were held in the Senate Chamber at the State Capitol. After the address of welcome by Mayor Mc-



Lean, the traffic session was conducted by S.C.M. Best and the C.M. from A.R.R.L. Headquarters. Code contests were next held for groups of novices, amateurs, and commercials. The crowd adjourned to the "Y" for a buffet lunch. Stunt night in the "Y" gym was under the capable direction of Physical Director Mahan. Everyone got acquainted and had a good time. Prizes were awarded those who excelled in the different contests. From the "Y" the gang went to the Central Maine Power Co. Auditorium for a dance and jamboree under the auspices of the C.M.P. Co. Girls Club.

Saturday morning a sight-seeing tour was the chief feature of interest. In the afternoon the Technical Session was held in the C.M.P. Co. auditorium. L.C. Brown of 1AQD demonstrated his ten-meter equipment in a very interesting way. L. B. Root of General Radio discoursed on crystal control. F.E. Handy exhibited a portable receiver and mentioned some of the considerations in its design. The 125 delegates assembled at the Augusta House for the big banquet which was broadcast through WCSH of Portland. "The Song of the Short-wave Ham" written by 1KE featuring T.O.M., the Wouff Hong and Rettysnitch was sung, broadcast, and placed on sale following the convention. A silver cup donated by W.J. Lee, 1BCY-4XE-NRRG, as a Naval Reserve award for the individual amateur and reservist in Maine, N.H., Vt., and Mass. for achievement in the past year was awarded to Evans of 1OC-1BFT with appropriate remarks. This identical cup will be awarded and engraved annually. After other prize awards and speeches by Hon. Wm.R. Pattangall, L.B.Root, F. E. Handy, Ralph Given of the C.M.P.Co. and A.A.Hebert, A.R.R.L. Treasurer-Field Man had been broadcast, the wire to Portland was opened. The remainder of the evening was spent in hamfesting and perusing three reels of movies sent up from Hartford.

During the convention a special ladies program was provided for those not interested in the technical sessions. A local drug store provided free soft drinks for the thirsty delegates. An amateur station in operation during the convention was much in evidence as a window display. Those in attendance were able to attend moving pictures at the Colonial Theater free at any time by showing their badges. Movies of the convention sessions and stunts taken by the Portland Press Herald were shown throughout the state during the next week as a special feature. Daily Reports of convention doings in the Kennebec Journal were of interest to the delegates. Bids for the next annual convention were made by representatives of Portland and Bangor and the Queen City Radio Club of the latter city is already working on plans for next year.

—*F.E.H.*

The Zepp

(Continued from Page 36)

quency by the amount X, which has the effect of shifting the voltage antinode V_2 from a point directly opposite V_3 along the wire away from the point directly opposite V_3 by the same amount X. In order to maintain the whole system in resonance with the desired frequency it is necessary to so adjust the feeder tuning as to in effect reduce the length of the feeder system by the amount Y. The current and voltage distribution in the two feeder wires is no longer symmetrical, and the two radio frequency ammeters A-A will not indicate equal values of current. We therefore shorten the length of the antenna by the amount X, and retune the feeder input circuit until the system is again in resonance. The two meters will now indicate approximately equal values of current, and the voltage and current distribution will be proper as shown in A.

There should be a current antinode (voltage node) at the center of the antenna inductance when the condition shown in A of Figure 6 prevails and this may be checked by touching the center turn with a neon lamp or point of a wooden-handled screw driver. There should be no glow from the lamp or spark from the screw driver.

In the actual process of adjustment, the antenna inductance and tuning condenser arrangement is connected to the input end of the feeders, as shown in Figure 7. The two ammeters are located equal distances from the top end of the feeder system, which also makes the distance from the antenna inductance and condensers to each meter equal. Therefore, when the current as indicated by the two meters is the same, there will be the proper distribution of voltage and current in the feeders and antenna. The length of the antenna, which we made a full ½ wavelength long in the first place, is cut off by about six inches at a cut until the difference in current as indicated by the two meters is not more than about ten percent. It should be remembered that the current as indicated by the meters may not be, and very probably is not, the maximum current in the feeders. The maximum current would only be indicated when the meters were located at current antinodes, which is not likely to occur in many cases. The importance of the readings of the two meters is not how much current they indicate, but the ratio of the currents at these two points opposite each other on the feeder system. If the distribution is perfectly symmetrical this ratio will be one to one, or both meters will read the same. The screw driver or neon lamp test on the center of the antenna inductance should indicate zero voltage at that point when the two meters indicate equal current, as mentioned above.

Figure 7 shows a suggested arrangement of the input end of the feeder system for

To Our Readers who are not A. R. R. L. members

Wouldn't you like to become a member of the American Radio Relay League? We need you in this big organization of radio amateurs, the only amateur association that does things. From your reading of *QST* you have gained a knowledge of the nature of the League and what it does, and you have read its purposes as set forth on page 6 of every issue. We would like to have you become a full-fledged member and add your strength to ours in the things we are undertaking for Amateur Radio. You will have the membership edition of *QST* delivered at your door each month. A convenient application form is printed below—clip it out and mail it today.

A bona fide interest in radio is the only essential qualification for membership.

American Radio Relay League,
Hartford, Conn., U. S. A.

I hereby apply for membership in the American Radio Relay League, and enclose $2.50 ($3 in foreign countries) in payment of one year's dues. This entitles me to receive *QST* for the same period. Please begin my subscription with the ..... issue. Mail my Certificate of Membership and send *QST* to the following name and address.

.....

.....

Do you know a friend who is also interested in Amateur Radio, whose name you might give us so we may send him a sample copy of *QST*?

..... Thanks

the amateur station where quick QSY with a minimum of time and effort is desired. The connections between the antenna inductance and parallel tuning condenser should be "low loss" and with plenty of cross section to carry the tank current. The parallel tuning condenser should be

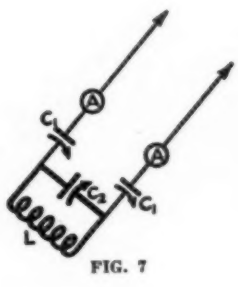


FIG. 7

capable of carrying the tank current without heating and should have a voltage rating approximately the same as that of the plate circuit tuning condenser of the transmitter. Its capacity may be around 250 μμfd. The series condensers may have a lower voltage rating but should be of the same quality, their capacity being also about 250 μμfd. maximum. L is the usual antenna inductance of about 5 to 10 turns. When the parallel tuning arrangement is being used, the two series condensers are set at maximum, and when the series tuning arrangement is being used, the parallel condenser is set at zero.

Strays

Zero LB suggests that the cover designs by 8ZZ should be signed something like this:

Darr! Darr! Darr did it
Darr! Darr did it
Darr! Darr did it

That General Radio plugs will screw into Sangamo fixed condensers is a point that should be of interest to anyone who wants to use plug-in condensers for any purpose.

—7MJ

THE FIRST WOMAN TO DISAPPROVE OF RADIO AS A HOBBY

The Fifth Age

(Continued from Page 39)

in ED. Anyhow I puts my best cq into geting acquainted, and before long we sound like two old maids at a ham convention. We walks on past the store, and neither one of us thinks anything about stopping. Our minds and my heart had qsyed liked someone had hanged a boarding house wash on my counterpoise.

Before either of us knew anything about it we were in front of her house and I was still holding on to her books.

"Sa," I sez, "would you get mad if I asked you something?"

"I don't know." she sez, "Go ahead and ask it."

I clears my throat, and like I was starting in to send one of those reliability msgs, I asks :

"I got a bid fer a frat dance and no date. Will you—Will you—er—go with me?"

She smiles sweetly or do I imagine it and sez:

"You will have to ask father."

That comes in R9 and sounds like bad qrn on a Saturday nite.

"Gee whiz. Holy condenser dials." I sez wondering what size shoe he wears. "When is he home?"

"Every evening," she sez. "He will be glad to see you."

"Yea;" I says, "just like he does a bill collector, and then he will be glad to see a bootblack." Just then her ma announces that if she expects to eat she had better get in and start to work.

I started walking home feeling as happy as a guy that has called an aussie and gets an R8 report only to find that he failed to get the last dot on the call. I had an idea what the qso with the old man would be like. I would step up sa hello and then provide the house with a new exit. A light bulb rose over my head. That was the reason CBY had laughed at me. He knew that I would get enough punishment to make up fer all the qrm I had ever caused him.

Anyway the next eve I goes over to the house per sked and asks for Helen. She takes me in hand and shoves me in a small room off the living room.

"Father," she sez, "I want you to meet Bill."

"Pleased to meet you," he sez between throwing out condensers, voltmeters, monkeywrenches and etc. out of a receiver that he had his head stuck in.

"Trouble?" I queries in a small meek voice.

"No. Not at all." he sez, "I am just taking my daily dozen."

"Oh." I sez and he immediately straightens up and I began a hurried search fer an exit.

"Do you know anything about a radio?" he asks.

"Very little." I sez, "What is the matter?"

"This thing won't work worth a darn, and I got a bet with one of the boys down to the office that I hear better dx tonight than he does."

"Do you hear anything at all?" I asks.

"Not a blankety blank thing." he returns.

"Ah, that sounds easier." I sez and sticks my head in the cabinet. If I can only fix the set I thought to myself I sure will be in good wid the old man. I looked through the whole thing without seeing a thing wrong, and in moving around to get a better look I feels a loose wire wid my foot. One look and I saw that the B bat lead fer the R.F. tubes was nil here. So I hooked it up when he wasn't looking and then I put my head inside again. When he was looking again I pulled my head out of the set and sez:

"There, I'll bet the thing will work." I turned the switch and immediately the room was flooded with music. He looks at me like I was the radio congress kicking the hams off the air fer good.

"Your sure a wonder. How in the world did you do it?"

"Well," I sez thinking of Peck's theory, "the syncronating by pass condenser was fowled with the neutralizing oscillating hetrodyning frequency, and after unjoining the diaphram it worked O.K. Now may I asked you a question? Can I—." but he had already plugged in the phones and was listening fer dx. He waved a hand at me. "Do anything you want. I have lost too much time now."

I walks out into the living room and announces that it is ok with the old man. So we qsy's to my leaping lena and dashes fer the dances.

About aussie time we return and the old man is as happy as a youngster with a new seven and a halfer. He has a list of W's as long as an unraveled filter condenser.

"Just wait until I tell the gang about this," he sez, "It sure will make 'em sit up and take notice." and he chuckles to himself in anticipation of the great time he will have.

"Sure is ok with me." I sez and bids Helen an affectionate goodby using 88's as a standard.

On my way home I just began to wonder what CBY was so happy about. I will make him laugh up the other side of his face when I tell him about the hit I have made.

It is one month later. I have sold my tube fer twenty bucks, and my filter fer ten. Still I can't see just what the laugh of CBY's meant. Sure a funny thing. Guess it will be an unexplained mystery like the origination of static.

Oh, yes. I forgot to mention that CBY has a nice note with that new fifty of his.

HAM-ADS

ANNOUNCEMENT

Effective with the October, 1928, issue of *QST* the following changes will be made in the rules of this department. The Ham-Ad rate will be 15c per word. The restriction which has limited use of this column to members of the American Radio Relay League will be removed and advertising may be signed either by company name or by an individual. A special rate of 7c per word will apply to advertising which is obviously non-commercial in nature and which is placed and signed by an individual member of the American Radio Relay League. Please read carefully the following conditions under which advertising in these columns will be accepted.

(1) Advertising shall pertain to radio and shall be of nature of interest to radio amateurs or experimenters in their pursuit of the art.
(2) No display of any character will be accepted, nor can any special typographical arrangement, such as all or part capital letters, be used which would tend to make one advertisement stand out from the others.
(3) The Ham-Ad rate is 15c per word, except as noted in paragraph (6) below.
(4) Remittance in full must accompany copy. No cash or contract discount or agency commission will be allowed.
(5) Closing date for Ham-Ads is the 25th of the second month preceding publication date.
(6) A special rate of 7c per word will apply to advertising which, in our judgment, is obviously non-commercial in nature and is placed and signed by a member of the American Radio Relay League. Thus, advertising of bona fide surplus equipment owned, used and for sale by an individual or apparatus offered for exchange or advertising inquiring for special equipment, if by a member of the American Radio Relay League, takes the 7c rate. An attempt to deal in apparatus in quantity for profit, even if by an individual, is commercial and takes the 15c rate. Provisions of paragraphs (1), (2), (4) and (5) apply to all advertising in this column regardless of which rate may apply.

charge in series up to 160 volts $2.75 to $4.00. Trickle B Charger for 90 to 150 volt "B" $3.75. Special transmitter "B" batteries up to 6,000 milli-amp capacity, any voltage. Write for interesting literature, testimonials, etc. B. Hawley Smith, 360 Washington Ave., Danbury, Conn.

FOR a number of years we have been supplying the highest quality apparatus to laboratories, universities, broadcast, experimental, marine and amateur stations. Building to order as well as standard items for any particular field of the art. Our long experience is your guarantee of quality. Merely state the items in which you are interested for literature covering same. Thos. Ensall, 1208 Grandview Ave., Warren, Ohio.

JEWELL Meters, new, 25% discount. We stock Hammarlund, Ward-Leonard, Acme, Thordarson, Pyrex, National, Cardwell, Baldwin, CeCo, Yaxley, Signal, Bakelite, Samson, Raytheon, RCA, Browning-Drake, Fleron, Ferranti, REL, Aero, Eby, Victoreen, Silver-Marshall, Tyrman, Tobe, Shield Grid Tubes, Carter, Bodine, Clarostats, Air Chrome Speakers, Exponential Horns, Abox, Kingston, Marco, Ham Call Books, Keys, Relays, Buzzers, Exide, Philco, Westinghouse, Fritts, Newcombe-Hawley. Many other lines of Ham and BCL apparatus. Tell us what you want. Discounts to Hams, dealers and custom set builders only. Roy C. Stage, Montgomery & Burt Sts., Syracuse, N. Y.

OMNIGRAPHS, teleplexes, condensers, crystals, transmitters, 50 watters, supersyncs, S tubes, Vibroplexes, electric and portable receivers. Phone transmitters, motor generators, receivers chokes. Bought, sold, exchanged. L. J. Ryan, 9CNS, Hannibal, Mo.

FOR sale—complete station receiver DET and 2 step transmitter TP TG 15 watt panel mounted with meters, etc., $100.00. 9JG, 3681 Rutger Street, St. Louis, Missouri.

SALE only—Grebe 18, new condition, fifty dollars. George H. Smith, Charleroi, Penn. 8ANC.

SELL or trade: Western Electric portable navy telephone transmitter and three tube receiver complete, $40.00. RCA transmitter model ET-3619 Kenotron power unit model ET-3620 complete, $60.00. Rectifier tubes, meters, coils, microphones. Real bargains. Write for bargain list. VE2AC, Box 221, Thetford Mines, Quebec, Canada.

LARGE 22½ volt Rayovac batteries, 89c, RCA 50 watters, original cartons, $12.00, REL 50 watt sockets, $1.50, 6 months guaranteed new 210s also 281s each $4.50, 6 months guaranteed 201As and 199s 79c, Readrite 2 meter tube checker, $3.00, Resistometers 49c, RCA 535 rheostats 29c, other rheostats all sizes, 15c, Willard storage B batteries $1.95, Kodel silent 2½ amp. homecharger $4.75, Bradley switches 29c, Federal transformers $1.19, pure aluminum 1/16" thick, sq. ft. 80c, Electrad 5000 ohms, grid leak 50c, rubber panels 1c sq. inch Bakelite panels 2c sq. inch, Amateur Call Books 85c. Westinghouse four volt socket power $6.25, six volt $7.50, Brandes phones $2.50. Free list, everything for hams. D.L. Marks, 125 Madison Ave., Albany, N. Y.

LOOK—9EYT selling out. Write for list! UX852 never used, $27.50. Set Aero coils, $6.00. 12 Jewell meters cheap. Complete transmitter and receiver, $20.00. 9EYT Lincoln, Illinois.

QSL hams: Stock up in neat and reasonable cards now. Samples on request. Radio 1NQ, 206 Metropolitan Ave., Roslindale, Mass.

SELL—3 Coto-coil condensers; one each 23 plate, 17 plate, 33 plate; marble base key, 10 amp.; home-made relay, large single contacts; 2 WE VT2; 3 WE VTls; Cootie key; Hammarlund SLF, 5 plate, 23 plate; Cardwell 43 plate; Baldwin type G. Make offer, M. B. Seyffert, Phoebus, Virginia.

SELL—new 203 (50 watter) $15.00. Slightly used 203A, $15.00. Both tubes guaranteed in good shape. L. B. Hallman, Jr., 508 S. Oates St., Dothan, Ala.

HAMS: Get ready for winter DX. Order your QSL cards now, with new Intermediate. Satisfied hams everywhere. Highest quality work. Prompt service. If you need cards send stamp for samples and prices. 8CUX, Millington, Michigan.

FOR sale: the new 15 dial Omnigraph, with 32 dials, cost $41. First best offer takes it. Prepaid. Write 8DII, 34 Howard Ave., Binghamton, N. Y.

FOR sale, No. 117 Jewell Service Test Set, complete with batteries. Cost $90.00. Sell for $55.00. Will service all kinds of sets and tubes. L. W. Van Slyck, Ironwood, Michigan.

FOR sale—Jewell No. 34 0-15 volt AC $3.00; Jewell No. 33 0.300 mills d.c. $3.00; Weston No. 301 0-800 mills d.c. $3.50; 2 Jewells No. 64 0-8 amps TC $4.00 each; Jewell No. 53 0-8 volts d.c. $2.50; General Radio hot-wire 0-7 amps. $1.50. Also four Xtals SRS at different frequencies in 160 meter band at $7.00 each. R. A. Donnelly, 2CPD, Brielle, N. J.

QRH? Will your wavemeter do next year? Does it cover the ten meter band? We'll rebuild it to meet the new requirements. We calibrate amateur wavemeters to an accuracy of one fourth of one per-cent. Two bucks for any band, three bands five bucks. All calibrations from standard frequency crystal oscillators. All work guaranteed. Higher degree of accuracy if desired. We build precision laboratory wavemeters and oscillators. Write for dope. Something new, center-tap kit for filament transformers. Ask us. QRX We can save you money on all standard radio apparatus. Write for prices. 9BVC, Lutesville, Mo.

SOMETHING for your notebook! Complete diagram and three page explanation RCA 200 watt, 500 cycle, ACW transmitter. See July hamad-price fifty cents. C. O. Slyfield, 8LA, Frankfort, Michigan.

WANTED—power filter and rectifier supply for 250 watt tube. C. J. McDonald, Dresser Junction, Wis.

Hams: Get our samples and prices on printed call cards made to order as you want them. 9APY Hinds, 19 S. Wells St., Chicago, Ill.

FOR sale or trade. Delco light plant 10 amp. 32 volts no batteries, in A1 condition. Worth $65. Want 1000 MG set. Will pay difference. 6ARV, Earle L. Mallette, Box 269, Saratoga, Calif.

NEON tubes—General Electric type G10, $1.00 each. Add postage. Radio 9AUB, 1231 South Meridian St., Indianapolis, Ind.

SELL low power xmitter, power supply and receiver. Cardwell, Aero, Thordarson, etc., parts. Fine for beginner. Almost new at less than half cost. 6CKS, Hurley, 1180 Mullen Ave., Los Angeles, Calif.

TRADE Conn. C melody saxophone and case for REL apparatus or GR type 358 wavemeter, Weston or Jewell meters, or what have you? C. E. Peterson, 2719 Price Ave., Cincinnati, Ohio.

SELL—Acme 150 watt filament transformer, $7.50. 1IV, 66 Vine St., Bridgeport, Conn.

CHOKES, 30H 100 M.A. $2.00. 30H adjustable 160 M.A. $5.00. 250 M.A. $7.50. Transformers, 500 to 1000 each, side midtap, 250 watt $8.00. 325-325-7½-7½ $5.50. 275-275-5 $4.00. Complete new lists and specifications ready. M. Leitch, Park Drive, West Orange, N. J.

AERO coils, REL transformers, grid leaks, chokes, xmitting tubes, and other items. New and of standard makes, priced low. Write for list. H. A. Carr, 1114 Monroe St., Vicksburg, Miss.

WANTED, 24-1500 or 32-500 volt dynamotor. 9CHZ, Wisner, Neb.

QSL cards, 100 two colors, 85c. New enlarged line. Cartoons, radiograms, stationery, etc. H. M. Selden, Cranesville, Penn.

CURTIS says its DX time now! Thordarson mounted transformers: 550-volts each side, two 7½-volt filaments, each $20.00; Thordarson 350-550 power transformer $16.00; 1000-1500 power transformer $22.00. Special Thordarson 650-volt power-filament transformers for 7½-watters $6.90. Aluminum square foot 85c; Lead square foot 85c. Potter 2-Mfd tested 1000-volt condensers $2.19. "Ham-List" 4c. James Radio Curtis, 5-A-Q-C, 1109 Eighth Avenue, Fort Worth, Texas.

HEADQUARTERS for hams:—Mueller 150-watt input tubes $15.00. Aerovox 1,000-volt 1-mfd condensers $1.29. New complete 7½-watt transmitters: tube, transformer, rectifier, key, etcs. 20-40 meters $40.00. Receivers 20-40 meters and one-step $17.50. Potter 2000-volt tested 1-mfd Condensers $2.50; 2500-volt 1-mfd condensers $3.25. Amateur Callbooks $1.00. "Ham-List" 4c. Robert Curtis, 1109 Eighth Avenue, Fort Worth, Texas.

COMPLETE 50-watt short wave transmitter with power supply, tube rectifier, wave meter and specially built receiver. This is a first class, complete, powerful transmitting and receiving station for which I have no further use because of business interests. Parts are finest obtainable, consisting of Acme, Thordarson, National, General Radio, Weston, RCA, etc., and cost over $400. Will sell everything complete for $150 cash and guarantee purchaser first class condition. List of parts on request. K. N. Ford, Apt. 3-J, 7010 Continental Ave., Forest Hills, Long Island, N. Y.

WESTINGHOUSE radio frequency ammeter. Type Cay. Range 0-10 amperes with protective shunt. Switchboard